UPPER COLUMBIA RIVER DEVELOPMENT

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JOINT HEARINGS

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INTERIOR AND INSULAR AFFAIRS

AND A

SPECIAL SUBCOMMITTEE

OF THE

COMMITTEE ON FOREIGN RELATIONS

UNITED STATES SENATE

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UPPER COLUMBIA RIVER DEVELOPMENT

THURSDAY, MARCH 22, 1956

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR
AFFAIRS, AND A SPECIAL SUBCOMMITTEE
OF THE COMMITTEE ON FOREIGN RELATIONS,
Washington, D. C.

The committee met, pursuant to call, at 2:10 p. m. in room 224, Senate Office Building, Senator James E. Murray of Montana (chairman) presiding.

Present: Senators James E. Murray, Montana; W. Kerr Scott, North Carolina; Richard L. Neuberger, Oregon; Henry C. Dworshak, Idaho; and Barry Goldwater, Arizona.

Also present: Senator Wayne Morse, Oregon, representing the Committee on Foreign Relations.

The CHAIRMAN. This hearing was scheduled to be held at 2 o'clock. I suppose other members of the committee will drop in. I think we had better start now so as to make some headway here.

I have a brief statement to make.

The purpose of these hearings is to give thoughtful consideration to the problem of properly conserving and making the best possible use of one of our Nation's greatest natural resources, the Columbia River system. In view of the importance of the problem, I have suggested retention of jurisdiction over it by the full Committee on Interior and Insular Affairs.

Involved in these hearings are international questions with respect to our good neighbor on the north, Canada. For this reason I have asked Senator George, chairman of the Senate Foreign Relations Committee, to join with the members of the Committee on Interior and Insular Affairs in these hearings. Senator George has very kindly consented and has appointed a special subcommittee to meet with us, consisting of six Senators whose home States are directly affected by our relations with Canada: Senators Morse, Mansfield, Langer, Wiley, and Aiken, and Senator Humphrey as chairman. We are very glad to have these distinguished gentlement sitting with us, when they can do so, in order to give the fullest consideration to this important problem.

Waterpower is our only perpetually renewable resource, except the sunlight itself. As long as the snow and the rain continue to fall in the mountains of the Northwest and run off down to the sea, the Columbia River will continue indefinitely to bring great benefits to the people of the region. Every day this great river runs to the sea with any stretch of it unharnessed constitutes another day of wasted resources. But in our haste to achieve development we will do well to remember that we are sowing where many future generations will

reap. If we sow partial development, future generations will reap inadequate benefits—and very possibly in a day when we may be straining every sinew and resource of the Nation in a fight for survival. We witnessed such a threat in the case of Grand Coulee a generation ago. Fortunately, we followed the wise course of full and adequate development, and so we are now reaping the benefits of that course at Grand Coulee. Today we must insist upon the same wise course in connection with the development of Hells Canyon and every remaining undeveloped power site on the Columbia River system.

If we cannot afford partial development, neither can we afford delay such as I find occurring today in my own State of Montana. There Libby Dam, first on the priority list of the Army engineers and the greatest flood control and storage site in the Columbia Basin south of the Canadian border, remains unbuilt because of the breakdown of our negotiations with Canada.

Above the border Mica Creek Dam, the finest storage site in the entire basin and the key to the development of the Columbia River in Canada, is similarly mired down. This is so despite the offer by the Puget Sound Utilities Council to build it and present it to Canada solely in return for the benefits its stored waters could create south of the border in this country.

At the same time we have learned of proposals to divert parts of the Columbia and Kootenai Rivers for use solely within Canada, thereby depriving the United States of any benefit whatever from the waters so diverted, and we hear Canadian leaders declare that their study of such proposals is the result of the intransigence of United States representatives in negotiations.

This apparent impasse in our negotiations with Canada, combined with the present administration's repudiation of its responsibility for carrying out further river development in this country, has created an incipient power shortage in the Pacific Northwest. Such a shortage, if it persists and develops, will have serious adverse effects upon the economy, the industrial growth, and the contribution to the national welfare of this whole section of the country.

These hearings have been called to attempt to determine what the weaknesses in the present program are and what steps should be taken to assure real progress in the future. In attempting such an analysis, I first asked Senator Neuberger to go to Canada and determine what the attitudes of Canadian groups and officials are concerning this problem. Last October he visited Canada and made a comprehensive 44-page report to me in December, excerpts from which will be included in this record at the close of my remarks as an introduction to these hearings and to the problems under consideration.

Our testimony today will deal with the work of the International Joint Commission and our relations with Canada. The two major witnesses will be Mr. Len Jordan, Chairman of the United States section of the International Joint Commission, and Mr. Outerbridge Horsey, Director of the Office of British Commonwealth and Northern European Affairs of the Department of State.

I have further invited the Federal agencies directly concerned with the issues to present testimony at these hearings as well as any interested private or public groups. Next Monday we shall hear witnesses from the Army engineers, the Federal Power Commission, and

the Department of the Interior. Other interested groups will be heard the second week in April.

Now, I believe Senator Neuberger has a few remarks he wishes to make at this time.

STATEMENT OF HON. RICHARD L. NEUBERGER, A UNITED STATES SENATOR FROM THE STATE OF OREGON

Senator NEUBERGER. Mr. Chairman and members of the Interior Committee and of the Foreign Relations Committee, I appreciate this opportunity to be the opening witness in these hearings on a subject which I believe to be of the most far reaching importance both to the State which I, along with Senator Morse, represent, and also to the friendly relations which we enjoy with our Canadian neighbors. I shall be very brief. What information I have on this problem, and my own views concerning it, I have already set forth extensively in my report to you, Mr. Chairman, which was printed as a committee print last December 15. I ask that excerpts from this report be made a part of these hearings and be reprinted in the record of the hearings immediately following my present remarks.

Mr. Chairman, as one of the Senators from the State of Montana, and as one who for many years has been intimately concerned with the development of the vast water resources of the Columbia River Basin, you have, of course, long known about the significance of the fact that the upper portion of that basin is located in Canada, in the Province of British Columbia. The stalemate over the construction of the great Libby project on the Kootenai River, which was authorized by Congress in 1950, has illustrated the difficulty of reaching agreement on the development of an international river basin of this kind without a most thoroughgoing analysis and constructive solution to the problems of an equitable allocation of costs and benefits between the countries concerned.

It was, of course, in recognition of the importance of this problem that you asked me to make my study trip to British Columbia last autumn. I am also glad that, in recognition of the importance of the international aspects of the problem, Senator George appointed a subcommittee of members of the Committee on Foreign Relations to join in the present hearings.

But while you, Mr. Chairman, and several other Members of the Senate have been concerned for some time about the apparent lack of progress in the development of a mutually beneficial program with Canada for the upper Columbia Basin, this important question has not so far received in this country nearly the public attention which it merits. In Canada, on the other hand, it has received a great deal of attention. Just 1 year ago now, in the spring of 1955, the Committee on External Affairs of the Canadian Parliament held very extensive hearings on the Canadian program for developing the wholly unharnessed hydroelectric potential of the upper Columbia River in British Columbia, and on the point of view of the Canadian representatives toward the kind of agreement which they believe will be needed with the United States to permit progress on development of these resources. I have felt, therefore, as I have stated in my report, that it was high time that similar hearings were held by the United

States Senate to clarify our own program and position toward these issues.

I believe all members of this committee know and understand the urgency of reviving, at the earlist possible time, progress toward the full development of the low-cost power potential of the Columbia River Basin, and I shall not say any more about this at this time.

However, I just want to emphasize that the urgency of finding, as soon as possible, a program of development mutually beneficial to both Canada and the United States is greatly increased by the threat which is posed to the entire Pacific Northwest and our country by the possibility that Canada may decide—in the absence of an agreement with the United States—to divert into the Fraser River system, entirely within British Columbia, all the flows from the Kootenai and Columbia Rivers which may legally be so diverted under the treaty of 1909.

It is, of course, apparent that such diversions, if they take place, will be disastrous for the future of our own Pacific Northwest, and that it will raise the gravest kind of conflict between ourselves and the nation which may probably be correctly called our closest friend and neighbor. That this threat is not merely an empty gesture is verified by the fact that Gen. A. G. L. McNaughton—the illustrious soldier-engineer who is Chairman of the Canadian Section of the International Joint Commission—thoroughly believes in the engineering feasibility of the diversions, and that the Canadian Parliament last year voted a very substantial appropriation to follow through on the engineering studies of the diversions and to try to establish their economic feasibility.

Mr. Chairman, as I stated in my report, I believe that this is a problem which deserves the highest-level attention in those agencies of our Government which are charged with responsibility for our river systems—for flood control, for navigation and reclamation and hydroelectric power—and for our foreign relations. Obviously, also, Mr. Chairman, the position which the United States takes toward programs of future development of the upper Columbia Basin in Canada are intimately connected and should be consistent with our overall program for the development of the same Columbia River Basin within the United States.

I hope, Mr. Chairman, that these hearings will bring out whether or not the present administration has such an overall program for the coordinated development of the entire Columbia Basin, so as to be able to judge the proper role of upstream storage in Canada in such a program; and that the hearings will also determine, with some greater certainty than seems now to be possible, who in the administration has the actual responsibility for formulating our policy in this respect.

I hope, also, Mr. Chairman, that these hearings will help bring further constructive proposals for the earliest possible development of a program for progress in the entire Columbia Basin; but if it does no more than to determine how and by whom this policy is to be formulated, and to draw public attention to the importance of having a meaningful and constructive program for this development, they will have served a useful purpose.

Mr. Chairman, I shall have more to say on this subject on future occasions, but I do not want to take the committee's time any longer at this time.

I think we should proceed with other testimony. I want to say one thing as I conclude.

My distinguished senior colleague and I this morning and yesterday have been in hearings dealing with the anxiety of many people in the Pacific Northwest over hydroelectric power development on rivers where there are fisheries. I could not help but think, Mr. Chairman, as I sat in those hearings that it thus becomes doubly important to obtain the maximum power, both through storage and actual generation, on the upper Columbia River, and at projects like our own Libby project in Montana, for this reason:

The upper Columbia River has already been shut off for fish propagation. The great dam at Grand Coulee, which you referred to in your opening statement, Mr. Chairman, has been a blockade that no migratory fish ever can surmount. So here we have the vast upper basin of the Columbia River, with great flows of water, deep canyons, wonderful places for storage, both there and downstream, where absolutely no fishery situation is involved. That is a further reason I would like to add to my statement for bringing about the maximum development of hydroelectric power and storage for flood control and perhaps irrigation and other related benefits on the upper Columbia.

I want to say to you, Mr. Chairman, that I appreciate the assignment which you gave me to go to Canada last October and to get for you and the committee certain basic facts about this because I learned a great deal which I otherwise would not have been able to inform myself on had you not given me that assignment. I appreciate it and I hope that my report was of some slight contribution to this great problem.

The CHAIRMAN. Thank you, Senator Neuberger, for the very informative statement you have made. I think for the sake of providing a full record in these hearings we should have included, at the end of the excerpts from Senator Neuberger's report to me, a copy of the 1909 treaty between the United States and Canada which created the International Joint Commission.

(The report referred to follows:)

EXCERPTS FROM STUDY OF DEVELOPMENT OF UPPER COLUMBIA RIVER BASIN, CANADA AND UNITED STATES

Report to the chairman of the Senate Committee on Interior and Insular Affairs submitted by Senator Richard L. Neuberger, of Oregon

SENATE INTERIOR AND INSULAR AFFAIRS COMMITTEE,
September 26, 1955.

Hon. RICHARD L. NEUBERGER,
Portland, Oreg.:

As chairman of Interior and Insular Affairs Committee, I am disturbed by reports of Canadian plans for storage and upstream diversion of Columbia Basin waters. These reported plans, coupled with the fact that negotiations for additional water storage across international boundary are stalemated, would have major impact on legislation now before the committee. I am especially concerned with effects of Canadian plans on future Northwest irrigation development and the extent to which they might impair usefulness of present multiple-purpose dams. Believe immediate study imperative and urgently request that you, as

member of our special subcommittee, investigate these reports between mid-October and arrival in Oregon of special subcommittee early in November.

Regards,

JAMES E. MURRAY, *United States Senator.*

SEPTEMBER 29, 1955.

Hon. RICHARD L. NEUBERGER,
Portland 5, Oreg.

DEAR SENATOR: My telegram regarding a canvass of Canadian Government plans for upstream diversion and storage of Columbia River waters was necessarily brief, and I thought it advisable to expand on some of the questions which I believe need immediate clarification.

The reports on Canadian proposals are most disturbing because of the implications they have on current river-development surveys on this side of the border. A complete resurvey of needed multiple-purpose dam projects in the United States portion of the river system is soon to be undertaken. It will be important to determine whether officials directing the Canadian river surveys have any plans to correlate their findings with similar United States objectives.

I would like to call to your special attention the negotiations which have been going on regarding the proposed Libby Dam project and the effect which Canadian diversion proposals would have on its power output and economic feasibility. Since our committee is charged with legislative responsibility regarding irrigation development, it would also be advisable to determine how upstream diversion would affect present projects such as Grand Coulee.

Several American industrial concerns and electric public utilities have indicated an interest in development of Canadian power sites. The new Canadian proposals may have an effect on the power supply of these interests, as well as the entire power supply for the Pacific Northwest.

Because of the far-reaching economic effects which the Canadian plans might have on future industrial growth in this country, I will await with interest your report on the attitudes of Canadian groups and individuals. I hope you will have an opportunity to talk with members of the Canadian Columbia River Basin Advisory Committee, who are closely associated with matters I have asked you to investigate.

We will be able to determine later whether hearings by the special subcommittee are necessary to develop additional information.

With kind regards,

Sincerely yours,

JAMES E. MURRAY, *Chairman.*

REPORT OF SENATOR RICHARD L. NEUBERGER TO CHAIRMAN OF SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS ON STUDY OF DEVELOPMENT OF UPPER COLUMBIA RIVER BASIN, CANADA AND UNITED STATES

INTRODUCTION

Between October 17 and October 24, 1955, I visited the Canadian Province of British Columbia at the request of Senator James E. Murray, chairman of the Committee on Interior and Insular Affairs, to inquire on behalf of the committee into the problems of the future development of the Columbia River in Canada.

My journey on behalf of the committee took me to Vancouver, to Revelstoke, to Boat Encampment at the "big bend" of the Columbia River, to the Arrow Lakes, Nakusp, Nelson, and Castlegar, back to Vancouver, to the Provincial Capital of British Columbia at Victoria, and to Seattle, Wash. In the course of this journey, I visited the sites of the major projects under consideration for the Columbia River in Canada, and I spoke with many Canadian leaders in the National and Provincial Governments, in industry and trade, in the press, and with Canadian and American engineers.

These conversations, and the interest I found everywhere in Canada in the subject of my inquiry, showed that our Canadian neighbors are far more alert than we have been to the immense significance of the manner in which the vast, untapped resources of their section of the Columbia River will be developed.

The Government of Canada has for some time been working to evolve a master plan for the development of these resources. The progress of this plan has been the subject of debates and of widespread public and press discussion in Canada. A key issue of the plan—whether or not to divert to the Fraser River in British

Columbia that portion of the flow of the Kootenay and Columbia Rivers believed to be beyond the present use of the United States—is of crucial importance to the United States. To the Pacific Northwest it means the difference between economic progress or stagnation. It is high time the issue received the official and public attention in the United States which it is accorded in Canada.

Negotations with Canada over the future of the Columbia River have been entrusted to the International Joint Commission created by the treaty of 1909. The commission is composed of 3 Canadian and 3 United States members.

The United States members are appointed by the President without confirmation by the Senate. Their present chairman, and the spokesman for the United State in these negotiations is Mr. Len Jordan, former Governor of Idaho. Before his appointment to his present position, Governor Jordan had a record of unrelenting opposition to the Federal program for the development of the Columbia River, and particularly to the construction of storage reservoirs at sites such as Hells Canyon, to increase the power output of downstream projects. It is precisely the development of such upstream storage dam sites at Libby in Montana and on the Columbia River in Canada, with downstream benefits at every Federal project on the main stem of the Columbia in the United States, which is at issue between Canada and the United States in the International Joint Commission.

Recommendations

As a result of my own study trip on behalf of the committee, I recommend that the Senate Committee on Interior and Insular Affairs schedule public hearings at the earliest possible time to inquire into the status of plans and negotiations for the development of the upper Columbia River to the mutual benefit of the United States and Canada.

On the basis of the report which follows, I also make these substantive recommendations for consideration by the committee at such hearings:

1. That responsibility within the United States Government for these important negotiations be raised from the level of a purely advisory committee like the United States Section of the International Joint Commission and be explicity assumed by the policymaking executive departments themselves.

2. That as long as United States members of the International Joint Commission are to play roles at least comparable to those of senior officers in the Foreign Service, their appointments be made subject to confirmation by the United States Senate.

3. That in its hearings, this committee thoroughly examine the past and recent statements by Governor Jordan on river development, with a view to determining if his profound bias and prejudice on issues of Federal power policy disqualify him from representing us in seeking further capacity for downstream Federal projects in the United States.

4. That this committee recognize as an important objective of negotiations with Canada the urgent need for upstream storage to provide effective flood control for the Columbia River farther downstream, particularly in view of the present administration's irresponsible abandonment of great floodwater storage reservoirs such as Hells Canyon on the Snake River, the main tributary of the Columbia in the United States.

5. That pending the active pursuit of agreement with Canada on the development of the upper Columbia River, the Congress act wisely and promptly to preserve for early Federal development the upstream storage sites in the Columbia River Basin within the United States. Especially it would be an unconscionable tragedy to sacrifice forever, in return for the small 1 million acre-feet private project favored by the present administration, the 4 million acre-feet of invaluable storage at Hells Canyon, wholly within the United States, while the storage potential of the upper Columbia is in danger of being forever lost to the United States through diversion into the Fraser River, wholly within Canada.

6. That this committee express its firm intent that, in our negotiations with Canada, no effort be spared to arrive at the best possible program for the development of the upper Columbia River—beginning now with the construction of the Libby and Mica projects—so as to maximize the mutual benefits to both countries which share this unique resource. Such a determined and constructive effort must give frank and open-minded consideration to the fair allocation of upstream costs and downstream benefits attributable to upstream storage—including possible sharing of benefits in generated electric power.

Failure to reach agreement on a mutually beneficial program for developing the Columbia River would threaten the gravest crisis in modern United States-Canadian relations, as well as incalculable economic loss to both countries. Agreement and execution of such a program, on the other hand, can assure economic progress for a generation to come for the Pacific Northwest in both countries, and can make a material contribution to the industrial and defensive strength of the North American Continent and the western alliance.

Geography of the Columbia River System

The water that drains each year into the basin of the Columbia River and its tributaries is the central natural resource of the Pacific Northwest. The drainage basin of the Columbia includes the greater parts of Washington, Oregon, Idaho, and western Montana and includes corners of Wyoming, Utah, and Nevada. It also drains a large area of southeastern British Columbia.

The future development of the States within the Columbia River Basin is vitally involved in our relations with Canada because the Columbia, in addition to being the greatest river system for hydroelectric power on the North American Continent, is also one of the truly international rivers of the globe.

Of the total 1,210-mile length of the main stem of the Columbia River, the first 465 miles are in Canada. The source of the river is in Columbia Lake, out of which the river flows northwestward in the direction of the Arctic watershed, until it is turned sharply west and south toward the American boundary by a union of the Monashee, Selkirk, and Rocky Mountain Ranges.

Although only 15 percent of the drainage basin of the Columbia River is inside Canada, the river derives a substantial portion of its volume from Canadian sources. Among these is the vast Columbia icefield, one of the last remnants of the continental icecap which once sheathed much of the continent. This immense hummock of ice nurtures rivers which drain to the Arctic, Atlantic, and the Pacific Oceans—the Columbia, of course, being its outlet to the Pacific.

Some of the major lakes of the western part of North America, such as Kootenay, Okanogan, and Slocan Lakes, contribute to the volume of the Columbia River in Canada. Important segments of such tributaries as the Okanogan, Kettle, Pend d'Oreille, Flathead, and Kootenay Rivers also are Canadian in origin.

Where it crosses the international border, the Columbia River carries 62,400,000 acre-feet of water. This compares with a discharge of 180,100,000 acre-feet at the river's mouth, near Astoria, Oreg. Thus, slightly more than one-third of the total volume of the Columbia River rises in Canada. This indicates the heavy reliance upon Canadian lakes, glaciers, and snowfields for the flow of the river which is the continent's greatest single reservoir of hydroelectric power.

Hydroelectric characteristics

Hydroelectric potential is the product of the volume of water and the available head—the vertical distance for which the water can be dropped through one or a series of turbines. Vast volume combined with a high head gives the Columbia River unique advantages for the production of waterpower. For example, although the drainage basin of the Columbia is only about 6 percent larger in area than that of the Colorado River, the volume of the Columbia is eight times that of the Colorado—frequently rising in floodtime to almost five-sixths the recorded maximum of the Mississippi River itself.

However, a third factor of usable hydroelectric potential along with volume and head is continuity of flow. Where winter snowfall and spring runoff cause great seasonal fluctuations in the volume of mountain rivers, storage reservoirs are needed to provide a continuous, controlled level of flow.

The average flow of the Columbia River at the border at its annual maximum is 10 times as great as its annual minimum. These enormous fluctuations are the basic reason for the importance to the United States of regulatory storage on the river's upper reaches—in Canada. The deep lakes and rivers canyons which help to feed the upper Columbia form natural basins for huge storage reservoirs.

The value of this vast potential storage in Canada, again, depends upon the head available for the downstream use of the stored water. The Columbia River crosses the border between British Columbia and the State of Washington at an elevation of 1,292 feet. Thus the United States would enjoy the benefits of Canadian storage from this altitude to tidewater. The possibility of retaining these benefits for themselves has led the Canadians to consider diverting part of the stored flow of the Columbia into the steep Fraser River, which drops to the Pacific entirely within Canada. Similarly, a part of the upper Kootenay

River's flow can be diverted to flow through the Columbia River in Canada, thus avoiding the drop of the Kootenay between its entry into the State of Montana and its return to Canada from Idaho, which gives the United States the benefit of a head of 570 feet.

Diversion of substantial parts of the natural flow of these great rivers would radically change the economic geography of the Pacific Northwest in both countries. It would forever foreclose the full development of the Columbia River Basin in the United States. This is the magnitude of the issues in the negotiations between the Canadians and ourselves.

POSSIBLE PROJECTS ON COLUMBIA RIVER IN CANADA

The development of the Columbia River in Canada stands today where it stood in the United States 20 years ago. Not a single dam today spans the Columbia River north of the border.

However, planning for the future of the upper Columbia Basin has the advantage of engineering studies of the river basin which have been carried on for many years. These studies by American and Canadian engineers, while not completed, have brought out the major outlines of the projects whose benefits must be weighed in selecting a plan of development.

A detailed engineering analysis of these projects is obviously beyond the scope of this personal report to the committee. They may be pictured, however, by the following brief descriptions in conjunction with the attached map of the northern portion of the Columbia River Basin. Going down the Columbia River from Columbia Lake, they are:

1. *Luxor.*—A possible site for a low-head dam of limited power output, which could back up Columbia River water to Columbia Lake or, in a case Kootenay River water is diverted into the Columbia as described in 8–11 below, could be combined with a dam on the Kootenay River to form a single large storage reservoir.

2. *Donald Canyon or Calamity Curve.*—Alternate possible sites for run-of-the-river power projects, or conceivably for a storage reservoir back to Columbia Lake in lieu of Luxor.

3. *Mica.*—A deep gorge site located just downstream from the big bend of the Columbia River. Present planning contemplates a 700-foot-high rock-fill dam with a head of 563 feet, forming a reservoir for approximately 11 million acre-feet of live storage and installed capacity of 1,100,000 kilowatts.

4. *Downie Creek.*—Site for a run-of-the-river power project with installed capacity of about 650,000 kilowatts to utilize flow regulated by Mica storage. (The name "Downie Creek" is used here in preference to the more commonly used "Priest Rapids" to avoid confusion with the United States project of the same name.)

5. *Little Dalles.*—Another site, near Revelstoke, for a run-of-the-river power dam with installed capacity of perhaps 400,000 kilowatts.

6. *Castlegar.*—A site proposed for a low storage dam below the Arrow Lakes which, by raising the level of these lakes 32 feet, could store about 3 million acre-feet for release to generate additional power at downstream dams on the Columbia in the United States.

7. *Murphy Creek.*—A site downstream from Castlegar, just above Trail, British Columbia, which could take advantage of the additional 42-foot drop of the river to increase the total Arrow Lakes Reservoir to 4 million acre-feet and add an at-site installation of 250,000 or more kilowatts.

8. *Kootenay Diversion.*—At Canal Flats, the Kootenay River runs south within only 1 mile of the origin of the Columbia River at Columbia Lake. Thus part or all of the flow of the upper Kootenay River could be diverted into Columbia Lake to flow down the Columbia River in Canada. The reservoir for such a diversion could be controlled by storage dams on the Kootenay River at

9. *Copper Creek or*

10. *Bull River.*—A potential site suitable either for a storage and power project for the Kootenay alone, or for a higher dam to create a reservoir of 3,400,000 acre-feet behind Luxor on the Columbia.

11. *Dorr.*—Below Bull River on the Kootenay just above the international border. Under study as another possible storage reservoir from which water from the Bull and Elk Rivers and other tributaries of the Kootenay could be pumped back into the Bull River Reservoir to flow down the Columbia in Canada.

12. *The Fraser River Diversion.*—This is the possible diversion of part of the flow of the Columbia River into the Fraser River, which is now under study by the Government of Canada as a means of keeping entirely within Canada all the benefits of upstream storage on the Canadian part of the Columbia River Basin. A diversion tunnel could run from the proposed Little Dalles Reservoir some 10 to 15 miles through Eagle Pass to Shuswap Lake or alternatively from the proposed Downie Creek Reservoir through Ratchford Creek to Shuswap Lake. Perhaps 15 million acre-feet of water stored at Mica and then diverted in this manner out of the Columbia River Basin into the headwaters of the Fraser River would augment the latter's flow during the low season, so as to make feasible extensive development of the entire head of the Fraser down to its entry into the Pacific Ocean at Vancouver—the major market for electric energy in British Columbia.

Of the possible Canadian projects which have been briefly identified in the foregoing paragraphs and on the accompanying map, only four are of immediate significance to the issues at stake in the negotiations between the United States and Canada which require the present attention of this committee. Later sections of my report, therefore, will deal in greater detail only with the significance of the Mica and Castlegar sites on the Columbia and of the possible Kootenay and Fraser River diversions.

Widely held Canadian views

* * * * * * *

There are obvious dangers in undertaking to report a single "public opinion" on any complex subject, and caution is doubly indicated if the opinion reported is that of people in another country, even if we share as many characteristics and traditions as we do with our Canadian friends. Nevertheless, I believe I found certain views expressed widely enough to be of significance to the committee. Of course, all the following statements of representative views should not be attributed to any one of the many individuals whose names appear in this report.

1. *Insistence on maximum development.*—The value of the vast hydroelectric power potential lying dormant in the river canyons of British Columbia is well understood north of the border. The people of the Province and their representatives have seen the progress which 20 years of Columbia River development in the United States have brought to the Pacific Northwest. They visualize an industrial empire for western Canada, built on the full utilization of the waterpower latent in their portion of the Columbia River Basin.

2. *Canadian resources for Canada.*—Canadians generally would prefer this full utilization to benefit the industrial development of their own Pacific Northwest and are averse to the direct or indirect "export" of their waterpower potential to the more developed power market of the United States. Their convictions in this respect reflect both national pride and a confident long-range view of the future of western Canada.

3. *Recognition of public responsibility.*—Both in public meetings and in private conversations, the view was repeatedly expressed that only the National Governments of Canada and the United States can work out a settled program for mutually beneficial upstream development and downstream benefits in the Columbia River Basin; and that the Dominion and the Provincial Government in British Columbia, acting in continuing cooperation with the United States Government, can best undertake developments of the magnitude of those possible on the upper Columbia River.

It is particularly striking to be able to report that not once did I hear the issue of "socialism" raised in discussing the best means of developing this great river, although I met with Canadians of nearly all shades of political opinion.

I spoke at length with Members of Parliament representing the people of British Columbia at Ottawa, who belong to the Conservative Party and to the CCF, and with many private individuals belonging to these, to the Liberal, or to the Social Credit Parties. Some of these men have been impressed with the success of the Tennessee Valley Authority and the Bonneville Power Administration and have proposed that their Dominion and Provincial Governments join in a Canadian program patterned after these famous American agencies. Some expressed misgivings about the participation of any United States investment, whether public or private, in the development of Canadian basic natural resources. But all dealt with the problem in terms of concrete, practical alternatives to the agreed com-

BRITISH COLUMBIA
ALBERTA
WASHINGTON
MONTANA
OREGON
CALIFORNIA
NEVADA
UTAH
IDAHO
SHADED PORTION SHOWS AREA COVERED BY LARGE SCALE MAP
JASPER
ROCKY MTN.
PROVINCIAL PARK
REVELSTOKE
KAMLOOPS
KELOWNA
PENTICTON
PRINCETON
CHILLIWACK
VANCOUVER
NORTH VANCOUVER
SQUAMISH
GARIBALDI PROVINCIAL PARK
FRASER RIVER
CANADA
UNITED STATES
VANCOUVER ISLAND
VICTORIA
PORT ANGELES
ZOSEL
OMAK
OKANOGAN
WELLS
CHIEF JOSEPH
GRAND COULEE
DAVENPORT
ROCKY REACH
WENATCHEE
ROCK ISLAND
EPHRATA
ELLENSBURG
PRIEST RAPIDS
YAKIMA
PASCO
KENNEWICK
WALLA WALLA
McNARY
ABERDEEN
OLYMPIA
CENTRALIA
CHEHALIS
RAYMOND
ASTORIA
LONGVIEW
COLUMBIA
JOHN DAY RIVER
THE DALLES
BONNEVILLE
PORTLAND
VANCOUVER
HILLSBORO
MORRISON CITY
SALEM
MT. ANGEL
PENDLETON
HEPPNER
BLUE MOUNTAINS
CASCADE RANGE
COAST RANGE
81071 O - 56 (Face p. 10)

NORTHERN PORTION
OF
COLUMBIA RIVER BASIN
Scale of Miles
SHOWING LOCATION OF DAM SITES
ON INTERNATIONAL WATERS
LEGEND
Developed dam sites
Potential dam sites
1. Luzor.
2. Donald Canyon or Calamity Curve.
3. Mica.
4. Downie Creek.
5. Little Dalles.
6. Castlegar.
7. Murphy Creek.
8. Kootenay Diversion.
9. Copper Creek.
10. Bull River.
11. Dorr.
12. The Fraser River Diversion.
WANETA
BOX CANYON
KATKA
PRIEST LAKE
LIBBY
GLACIER VIEW
HUNGRY HORSE
CABINET GORGE
ALBENI FALLS
KERR
THOMPSON FALLS
PARADISE
NINEMILE PRAIRIE
BRUCES EDDY
PENNY CLIFFS
SPOKANE
CANADA
UNITED STATES
CONTINENTAL DIVIDE
ROCKY MOUNTAINS
SALMON RIVER MOUNTAINS
A L B E R T A
I D A H O
M O N T A N A

mon goal of maximum economic development—not one placed partisan political slogans ahead of this common goal.

4. *Desire for Canadian-United States agreement.*—There is sincere concern over the threat to the traditionally close relations between the United States and Canada posed by the disagreement over Columbia and Kootenay River storage and by the possibility of partial diversion of these rivers in Canada from their natural course through the United States. Canadian investigations of the feasibility of such diversions are sometimes spoken of as studies necessary to evaluate the full economic potential of Canadian storage which may be sought in negotiations with the United States, and many do not expect that the diversions will actually be made over the determined opposition of the United States. At the same time, I found universal support in Canada for pressing forward toward mutual agreement between our two nations so as to permit the earliest possible start on the development of upstream storage and power projects in Canada.

5. *First priority for Mica project.*—The major general attitudes reported in the foregoing four paragraphs are sometimes reflected in other views which may be listed here as more specific applications of those attitudes.

The Mica Dam and Reservoir are regarded as the key project on the Columbia River in Canada. Plans for this project are far enough along to permit early construction, and no downstream power project in Canada is now known to be economically feasible without Mica Dam storage. Our own Libby project on the Kootenai River is sometimes linked with Mica, in the sense that the agreement on the issue of downstream benefits which is necessary for early construction of Mica may also permit the United States to proceed with this great authorized Federal project.

Canadians generally have confidence that their position in these negotiations is being represented to the full limits of their national interests under the leadership of Gen. A. G. L. McNaughton, who is respected as Canada's most illustrious soldier.

General McNaughton and the Dominion Government have opposed effectuation of the plan for Arrow Lakes storage agreed upon between the government of British Columbia and the Kaiser Aluminum & Chemical Corp., which I also sometimes heard criticized as less than full development and as an export of Canadian waterpower potential to foreign industry. A Dominion licensing requirement has been imposed by the adoption last June of a new Canadian International Rivers Improvements Act, and the Kaiser project is now regarded in some quarters as improbable. Because the proposal of the Puget Sound Utilities Council is to construct the Mica project to its full proportions, and to turn it and its at-site power potential over to British Columbia, there is apparently less opposition to that proposal, which is probably also not as widely known as that of the Kaiser company.

I would like to conclude this section of my report by assuring the committee again that, throughout my journey in Canada, I found the most alert and informed interest in the subject of Columbia River Basin development; that our Canadian neighbors are eager to agree with us on a program for the rapid utilization of upstream resources to the mutual benefit of the entire basin; but that they are also determined to secure their full share of these benefits in a manner which will promote the maximum economic development of their own country. I am deeply indebted, as a representative of this committee, to the generous assistance which so many public and private persons in Canada contributed toward the success of my mission for the chairman of the committee.

Issues Raised in Planning Upstream Development of Columbia River

The following section of my report is intended to identify some of the issues which have been raised in planning the development and use of the Canadian upstream storage potential.

It is obviously impossible, in this personal report, fully to cover the substance of the engineering, economic, and legal problems involved in planning a program of development for a vast river basin which is divided by an international border between two great nations. However, these problems must be solved to the satisfaction of both nations before there can be progress with the urgently needed construction of upstream storage and power projects on the Columbia River in Canada and at Libby on the Kootenai in Montana. It should be the function of public hearings by this committee, early in the coming session of Congress, to determine in detail how effectively the responsible agencies of the

United States are working toward the earliest possible solution of these problems.

THE CANADIAN POSITION ON ISSUES OF UPSTREAM DEVELOPMENT

Study of the future development of the Columbia River system was referred to the International Joint Commission by the Governments of Canada and the United States on March 9, 1944. The terms of the Columbia River reference, which is reprinted in full as appendix 5 hereto, ordered—

> that the Commission shall determine whether in its judgment further development of the water resources of the river basin would be practicable and in the public interest from the points of view of the two Governments * * *

and that—

> in the event that the Commission should find that further works or projects would be feasible and desirable * * * it should indicate how the interests on either side of the boundary would be benefited or adversely affected thereby, and should estimate the costs of such works or projects, including indemnification for damage to public or private property and the costs of any remedial works that may be found to be necessary, and should indicate how the costs of any projects and the amounts of any resulting damage may be apportioned between the two Governments.

As I have already mentioned, the Canadian section of the International Joint Commission is headed by Gen. A. G. L. McNaughton. General McNaughton is an engineer, as well as a celebrated Canadian military hero of both World Wars. Although under Canada's parliamentary form of government, he is not himself a member of the Government, there is no doubt that he works closely with the appropriate Cabinet Ministers, that his advice carries great weight, and that, in general, he represents the position of his Government toward the subject matter of the Columbia River reference.

During the spring of 1955, the position of the Canadian Government was given detailed public exposition in the course of parliamentary consideration of the International River Improvements Act.

This Act, then known as bill No. 3, was designed to establish a measure of Dominion control over the construction of projects on "international rivers," defined as "water flowing from any place in Canada to any place outside Canada." The occasion for the Dominion Government's introduction of this bill was universally recognized to be the Government's opposition to the Arrow Lakes project agreed upon between the Provincial government of British Columbia and Kaiser Aluminum & Chemical Corp., which threatened to interfere with the Dominion Government's own plans for the Columbia River.

The progress of these plans was explained to the Parliamentary Committee on External Affairs, holding hearings on bill No. 3, by General McNaughton, who testified and answered questions for 4 days. The following paragraphs will summarize and quote some of the general's testimony of special relevance to the present report. (The larger print is a summarized restatement, and the smaller, direct quotations of General McNaughton's testimony.)

At the time of the Columbia River reference, in 1944, the United States had numerous existing and planned projects and the elements of a long-range plan for development which even included the use of continued flows and storage of Canadian water.

"This is foresight and I take no exception to this exercise of initiative by our friends in their planning. It is a Canadian responsibility—not theirs—that we should assess the value of these resources and require due recompense if indeed we are to consent to their use to someone else's benefit at all."

Thus Canada's immediate need was to initiate topographic, hydrographic, and engineering studies of the Canadian part of the Columbia Basin, on the basis of which its hydroelectric possibilities could be evaluated. These studies are now far advanced but not quite completed.

Simultaneously, the Canadian and United States sections of the International Joint Commission have discussed the question of recompense by downstream power-generating agencies for benefits which they derive from upstream storage. The Canadian section has demanded recognition of the principle of sharing downstream benefits.

"Complete impasse" on Libby project

The immediate occasion for this demand was the application of the United States to build Libby Dam, authorized by Congress as a Federal project in 1950.

Located on the Kootenai in Montana, the proposed Libby Dam would require the full flow of that river from Canada to fill its 5 million acre-feet reservoir, which would flood 15,000 acres in British Columbia.

"Here the flooding at the boundary would be 150 feet and the upstream state, British Columbia, is entitled under this principle to an allocation proportional to this increase of level multiplied by the whole flow of the Kootenai from above the boundary.

"This represents something more than one-third of the total at-site power to be generated at Libby. This power would of course be paid for at the going rate to cover cost and return on investment. * * *" However, "the Canadian commissioners had not been able to persuade our colleagues in the IJC in the Libby case to agree to discuss any recompense whatever for the resources of Canada in the way of head and flow which were to be used in that project, if it were undertaken.

* * * * * * *

"Now, what did we do? We had from the United States this indication that they were glad to take our water and to give us nothing for it. We at once turned the attention of our engineers on the possibility of the use of those waters in Canada * * *. When the Kootenai is high, some of the water flows across Canal Flats into the Columbia, so that by building a dam below the river we could get 5,000 cubic feet per second on the average over the year out of the Kootenai, and put it into the Columbia where at least we would have the benefit of nearly 570 feet or more of head than we otherwise would * * *. I then invited our engineers in the study of the Mica Reservoir to examine the Monashee Mountains from cellar to attic, so to speak; * * * to ascertain if there was, in fact, any possibility of taking these waters through those mountains—or some portion of them—to use them through the two-thousand-odd feet of head in the Fraser Basin and so to generate power and get some return."

The Canadian commissioners expected to draw support for their position because it paralleled the draft of an interstate compact among the American States in the Columbia Basin and from the appointment of the former Governor of Idaho—an upstream State—as chairman of the United States section of the Commission. However, the draft of this interstate compact has met with strong opposition, and in the Commission "we have run up against a complete impasse."

"Turning again to Libby, may I mention that we now have the new application (May 1954) from the United States Secretary of State, Dr. Dulles. This does not seem to represent any more favorable approach to the problem of an equitable division of benefits. The reply made by the Government of Canada indicates we will not be prepared to go on with the discussion until we know the possibilities of the Kootenai division, among other matters."

The diversion studies

Because of the impasse on the issue of downstream benefits, further progress on the United States Libby application is thus being indefinitely postponed for completion of Canadian studies of the possibility of developing the storage potential of the Kootenai and Columbia Rivers for downstream utilization entirely within Canada. General McNaughton explained the three alternative plans of development which are under consideration by the Canadian Government:

"In the first case, there may be no diversions from one tributary to another under which condition the Kootenai will continue to flow in the wide loop through Montana and Idaho, dropping some 570 feet en route and making possible the large United States projects at Libby and Katka.

* * * * * * *

"Under this condition of no diversion, the Columbia waters would continue to flow into the Grand Coulee Dam unaltered in quantity, but, when Mica and Murphy Creek are built, these flows would be regulated to the extent of 10.5 million acre-feet and something more than 4.0 million acre-feet respectively, a service which is worth more than 14 billion kilowatt-hours annually to the United States in terms of on-peak power, to meet demands which otherwise could not be satisfied except by thermal generated power costing upward of 6 mills per kilowatt-hour.

In the second case, there would be no turbines or generators installed at the Bull River Dams and the waters of the upper Kootenai to the extent of some 5,000 cubic feet per second mean annual flow would be impounded in the Bull

River-Luxor Reservoir. This reservoir has a capacity of 3.4 million acre-feet and would feed down the Columbia through powerplants at Luxor, Donald Canyon, Mica, Priest Rapids, and Little Dalles; thence to the Arrow Lakes and Murphy Creek powerplant and across the boundary into Grand Coulee Reservoir.

"As far as the United States is concerned, the volume of water reaching Grand Coulee Reservoir is unaltered by this diversion of the Kootenai, but there would be a considerable loss of power potential on the Kootenai in Montana and Idaho represented by the 5,000 cubic feet per second of mean annual flow through 570 feet of head of which 232 feet might have been developed at Libby and 263 feet at Katka.

* * * * * * *

"In the third case, a tunnel about the size of those recently built by the Ontario Hydro at Niagara, would connect the Little Dalles pool with Summit Lake at the headwaters of the Eagle River. This tunnel would provide capacity to divert the stored flood water in the Luxor-Bull River and Mica Reservoirs to the amount of 15 million acre-feet annually at the times required for the regulation of the Fraser system. In passing to the Fraser these waters would first be used in the Mica powerplant and the Priest Rapids powerplant.

"Under this proposal, the energy conserved by the storage of the 15 million acre-feet in the Mica and Bull River-Luxor Reservoirs would all be generated in Canada, a considerable part in the Fraser River system in close proximity to the large markets; and by reason of its use for regulation making possible the development and use also of the normal flows of the Fraser itself.

* * * * * * *

"Upstream at Mica the Canadian head which may be used on the Columbia to near Revelstoke and thence down the Fraser in regulated flow is from a crest elevation above the sea to 2,440 feet, of which some 2,000 feet we forecast may possibly be developed economically."

This development depends, of course, on the availability of sites on the Fraser River and on the feasibility and cost of diversion tunnels through the Monashee Range. Both of these are still under investigation, but the evidence to date is tentatively favorable.

By late 1954, it seemed favorable enough to the Canadian Government that it budgeted $250,000 to be spent specifically on engineering studies of the Columbia-Fraser River diversion in the following year. The Canadian Parliament authorized this large special appropriation for that purpose on May 13, 1955.

The legality of the diversion of part of the natural flows of the Kootenay and Columbia Rivers which would normally reach the United States is predicated on article II of the Boundary Waters Treaty of 1909, the same treaty which created the International Joint Commission, which reads:

"Each of the High Contracting Parties reserves to itself * * * the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; * * *"

To carry out the provision for judicial remedies specified in this article, the Canadian Parliament in 1911 gave the Exchequer Court of Canada jurisdiction over claims of any party to have been injured by a Canadian diversion or interference.

(Chairman Jordan, of the United States Section of the International Joint Commission has argued that "obviously, the United States, as an injured sovereign, will not be limited to the redress provided for an injured party (spelled with small letter 'p') by article II.")

General McNaughton continued that, so far, there has been no occasion for the adjudication in either country of downstream rights under this provision. It may be argued that the remedy must be money damages, "for article II of the 1909 treaty reserves to the upstream country the exclusive jurisdiction over the use and diversion of such waters on its own side of the boundary. If the diversion could be halted by an injunction obtained by a citizen of the downstream country, this provision of article II of the treaty would be rendered meaningless. Whether or not an injured party would be entitled to obtain an

injunction, or only monetary damages, will only be known when and if a case is taken to the courts."

On the basis of the Canadian analysis of the volumes of flow which have already been developed below the border by the United States, the contemplated diversions could be carried out without impairing any legal interest of the United States under the treaty of 1909.

"But I must say that our margin of possibility has by now shrunk to something very narrow and unless we take appropriate action to protect our interests it may indeed vanish altogether."

General McNaughton made clear to the committee his firm conviction that the flow of Canada's rivers should be fully used for the economic development of Canada:

"Gentlemen, I do not believe there is another region in the world beyond this region of British Columbia of which we are speaking that has this opportunity to clearly lay out a progressive development down through the years and to have it operate in terms of cheaper power year by year as the development goes on.

"It is perfectly clear that in the long run all the water resources of the region will be taken up and we will have to look to more expensive sources of power in order to satisfy the demand of the people for energy. * * * We have nothing to spare. We need everything that we can get.

"The proposal which we have indicated to you is that of conserving the flow of Canadian ownership for Canada. There is every reason to believe, that in the course of 2, or at most 3, decades these flows will be fully taken into use.

"If we can arrange it and settle it that is what we should do, while we still have the power of decision in our hands."

Provincial role important in actual river development

I have included the preceding lengthy review of the statements of General McNaughton in my report to the Senate Committee on Interior and Insular Affairs because I think it is of special interest to the committee to have the Canadian position set forth in the words of the individual who, as Chairman of the Canadian Section of the International Joint Commission, is primarily responsible for representing his Government in the negotiation of these issues between Canada and the United States. Clearly, the general speaks with genuine enthusiasm of the possibilities for low-cost Canadian hydroelectric power development inherent in his plan of diverting all legally available flows of the Kootenay and Columbia Rivers in Canada into the headwaters of the Fraser River. It must be kept in mind, however, that in Canada ownership of rivers is held in the name of the Provinces. While the Dominion Government could perhaps take control of the construction of projects on these international rivers by declaring them to be "works for the general advantage of Canada," such a decision would mean a major break in Canada's federal constitutional tradition. General McNaughton recognized this when, in answer to a question, he told the Parliamentary Committee on External Affairs:

"Mr. Chairman, I hope that I never made a suggestion anywhere that anybody is going to compel the Province of British Columbia to adopt any of these developments. We have in the Commission a responsibility of studying the matter and putting up proposals and suggestions and recommendations to all the governments concerned. When we have done that that is where our responsibilities end. The responsibility is then with the government of British Columbia primarily to see whether they accept these recommendations and should get along with it or whether they reject it. What we depend upon in carrying perhaps public opinion with us in these matters is the expertness and validity of the information we will put forward. If we cannot carry public opinion with us in these matters, that is the end of it."

It is beyond the realm of my report to express any views about internal relationships within the Canadian federal system or about the manner in which the Provincial and National Governments may work out a scheme of development for the upper Columbia Basin. However, my report would be incomplete without a statement of the position of the provincial government of British Columbia on this subject.

On April 27, 1955, the provincial government submitted to the Parliamentary Committee on External Affairs its representations in the matter of bill No. 3, which, as stated earlier, was universally understood to have been designed to block the Arrow Lakes project agreed upon between the Province and Kaiser Aluminum & Chemical Corp. A copy of the entire document submitted by the

provincial government is being placed in the files of the Senate Interior Committee with my report.

In this representation Attorney General Bonner, of British Columbia, protested against what his government deemed inadequate opportunity for provincial participation in the process of planning river development in British Columbia:

"I would illustrate the shortcomings of this situation by pointing out that such major decisions on the part of the Canadian membership of the Board as the survey of the proposed Kootenay diversion, the proposed Columbia-Fraser diversion, or the diversion of the Shuswap to the Okanagan were made without the benefit of discussions on the committee level at which the Province had representation.

"The matter of the Kootenay River diversion study, which would naturally be of prime interest to the Province, was reported to the Province as a fait accompli by the direct distribution by General McNaughton of a copy of a report compiled by the Department of Northern Affairs and Natural Resources following investigations which were made without the knowledge of the Province of British Columbia.

* * * * * * *

"My purpose in raising this matter in connection with a bill devoted to the development and utilizing of the water resources of Canada is to suggest to this Standing Committee on External Affairs the need for reexamination of existing machinery dealing with water resources and, insofar as the work of this machinery deals with the water resources of British Columbia, the need for greater participation by, and representation of, the officials of the Province in matters of vital Provincial concern.

"Valuable as planning for hydroelectric development may be, the Province cannot consent to have casually planned out of existence certain portions of the Province, particularly if this is done by agencies in which the Province does not have suitable voice or representation, and which, on that account, are not responsible to the government of British Columbia."

His statement then expressed the concern of the government of British Columbia for early development of storage and power projects on which amicable international agreement could be reached without delay, in these terms:

"We are assured on all sides that our water resources, particularly those of the Columbia, are of increasing value.

"This is evidenced from the power shortage apparent in the Northwest States.

"Knowing the strategic value of industry depending upon Columbia waterpower, the fact that we are delaying the development of hydro installation in the United States while we in Canada pursue a leisurely examination of our own resources can only cause our American friends understandable exasperation.

"I think the time is at hand when we should concert our best efforts at the Federal and Provincial level to insure no further delay in the development of certain feasible and desirable projects on the Columbia.

"I have two in mind—the Mica Dam and Arrow Lakes storage, which properly go together. So great would be the combined benefit to the United States of the development of these projects that it has been suggested that American capital would be literally donated to Canada to insure these undertakings.

"Our sole expenditure would be for generating facilities, which soon would be offset by the value of downstream benefits returned to Canada in proper measure for Canadian use.

"I am advised that an immediate market exists for whatever energy return to British Columbia may be determined for Arrow Lake storage.

"It may be difficult to dispose immediately of the large power block of which Mica is capable.

"I would remind the committee, however, that successful negotiation by the Governments of Canada and the United States on the reduction of tariffs on strategic metals entering the United States would be almost immediately followed by increased activity of basic industry already established in my own Province, and also by accelerated industrial settlement by domestic and foreign capital anxious to take advantage of the abundance of cheap power which we can develop.

"Active discussions between British Columbia and Canada to this end should take place without delay.

"While we make no move to develop the Columbia, and oppose such American projects as Libby (which I think we are well advised to do), and in these circumstances talk of diverting the Columbia into the Fraser, we cannot hope to avoid creating resentment on the part of the United States to the detriment of our long-time good relationship.

"In my opinion the Columbia diversion requires more to commend it than I have heard so far.

"We must not endanger our salmon run in the Fraser, as did the Americans upon the Columbia.

"That is but one aspect, but it, too, is international.

"Neither must we be dog-in-the-manger in respect of water which for the moment may be called surplus.

"I know from the remarks of Len Jordan, Chairman of the United States Section of the International Joint Commission, delivered before the Canadian-United States Committee in Bermuda at its spring meeting in March of this year, that the Columbia diversion proposal has the ingredients of a major misunderstanding between the United States and Canada.

"I know all here would regret to see such a development. Frank discussions regarding waterpower among representatives of Canada, the United States, and British Columbia are clearly necessary for the harmonious development of the Columbia."

Negotiating the value of upstream storage

In placing a value on the downstream benefits to be attributed to upstream storage—if that storage is not to be diverted to downstream projects within Canada—General McNaughton has consistently held out for the cost of steam generation of power as the true measure. He explained his position to the parliamentary committee in this way:

"Now if this stored water is not available the only other relief is steam and it seems therefore that in such conditions the real value of the electrical energy derived from the stored water is the same as what it would have cost to produce it by the only alternative method—steam.

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"However, since a good bargain requires that both parties should benefit substantially, it is not to be expected that the upstream state will receive the full value in cash or the equivalent. Equity, of course, requires a division of benefits and so the amount to be paid in cash or in power will be somewhere in between the 'value' on the one hand and the 'cost' of the storage and its operation on the other. The exact division cannot, I think, be a matter of rule but must be the result of a bargain struck in each instance.

"What I do emphasize is that the 'value' to be taken into account is that of 'on-peak' generation by steam * * *."

This insistence that the "real value" of the power potential inherent in upstream storage is the cost of generating equivalent electric power by the use of steam represents the major premise of the Canadian position in the negotiations in the International Joint Commission. However, the genuine desire to reach agreement, and the recognition that agreement requires compromise, are equally apparent in the policy statements of the Canadian Government.

Perhaps the most comprehensive statement of the Canadian position is contained in an address by Hon. Jean LeSage, Minister of Northern Affairs and Natural Resources, before the Pacific Northwest Trade Association in Vancouver, British Columbia, May 9, 1955. This statement by the responsible Cabinet Minister provides an excellent summary of the views of the Canadian Government, and I therefore conclude this section of my report on the Canadian position by quoting it extensively.

The Minister stated that the same common resource which ties together the region of the Columbia Basin in both Nations also offers complementary sources of competition and conflict.

"Only part of the power potential of the Columbia River system can be developed through a series of dams using the available at-site head because there is a great difference between summer and winter flows. The optimum development of the basin will necessitate the construction of upstream storage facilities to provide downstream power and to keep costs low. Thus, joint action by upstream and downstream areas will in many cases be required to develop the power potential of the region economically.

"This complex set of relationships is further complicated by the physical possibility of diverting floodwaters from the Kootenay River into the Columbia through Canal Flats and from the Columbia River into the Fraser River system. * * *

"However, the fact that those diversions are physically feasible and that we have the right to make them does not of itself necessarily mean that they will be initiated. Economic considerations will have to be taken into account in

reaching a decision. That is why an investigation is now being made on the feasibility of the Kootenay and Columbia diversion projects. Results of these surveys are expected within a year.

"We want to obtain precise data on the benefits to be derived from these diversions and on their cost, including, of course, the possible damages to downstream interests. Once we know the quantity and the cost of power which could thus be made available, it will be useful to compare those data with the cost of thermal and atomic power. It will be particularly important to make such a comparison with the quantity and the cost of power that the downstream interests would be prepared to give in recompense for storage facilities if the floodwaters were not diverted. All the direct and indirect effects of these alternatives will have to be carefully examined before a final decision is reached.

"This brings us back to the competitive and complementary relationships existing between upstream and downstream areas in the Pacific Northwest region and raises the complex problem of downstream benefits. Given the strong competitive factors now opposing the two main groups of interests, it is quite understandable that the downstream areas would like to keep for themselves all the downstream power made available through regulated flow and to provide compensation only in terms of money for the damage caused by the upstream storage facilities. It is equally understandable that the upstream areas should refuse such proposals because even adequate compensation for damages does not add to their wealth.

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"It is evident that these opposite views must be reconciled in order to reach a satisfactory arrangement. Some compromise will have to be worked out whereby the upstream areas will receive an adequate and fair share of downstream power. I am convinced that this claim of the upstream interests is perfectly justified. It should be noted that the power be made available under those particular conditions is a joint product resulting from the joint enterprise of upstream and downstream interests. The downstream areas provide the head which is certainly a valuable resource, but the upstream areas contribute the storage sites which are required to regulate the flow of water and also may permit flooding above the boundary to increase the head below. It cannot be denied that a topography favorable to storage sites is a very valuable asset which can be utilized in perpetuity. It follows therefore that when downstream and upstream areas decide to use their respective physical assets jointly for the generation of power, they both have a claim on the end product. Moreover, they make make their contribution in physical terms—even though some expenditures are involved to develop the natural resources—so that they are both entitled to a quantity of the joint product in physical terms."

This is a clear and concise presentation of the Canadian claim, not only to the principle of "downstream benefits," but also to the division of these benefits in kind—in electric power rather than in money.

However, Canada appears to seek consideration of payment simultaneously with consideration of the principle of sharing power itself. Assertion of the latter principle does not mean abandonment of the "steam cost" theory of the value of Canadian storage to the United States.

"The real value of power in the United States Pacific Northwest is represented by the cost of producing additional power from the cheapest source now available in the area. Canada cannot be expected to permit the sale of its power on the United States market at a price much lower than this cost. Is Canada reasonably to be expected to use its own resources in such a way as to encourage new industries to locate on the other side of the boundary where they will have immediate access to the United States market, where they will enjoy tariff protection and get cheap power as well? Our first duty is to use Canadian resources to foster Canadian development. * * *

"If the application of this policy results in some region having a temporary surplus of power this is no reason to think the policy is wrong. We can be sure the surplus will be only temporary. Moreover, it is not a surplus of power, but a shortage which creates great difficulties and which brings industrial expansion to an end. A temporary surplus of power is the very condition of economic progress in the age of modern technology. Power projects require several years to be completed but the demand for power may rise suddenly. That is why regions enjoying temporary surpluses possess a great economic advantage and must think twice before deciding to part with it."

We might wish that the facts expressed by Mr. LeSage in these last few sentences were more clearly understood by those who, in the cause of special interests or from a narrow sense of false economy, have attacked as "white elephants" the great Federal low-cost power projects on the Columbia River in the United States. Evidently, our Canadian friends have learned the lesson of hydroelectric power development in the Columbia Basin better than many of those now in control of that development in our own country.

The Canadian Minister concluded his address with this review of the next step to be taken toward developing an agreed program for Canadian storage in the Columbia Basin:

"It seems to me that all parties concerned should make known in the near future whether or not they accept the principle of sharing downstream benefits. As far as we are concerned in Canada, I have attempted to make our position clear on this. If there is general agreement on the principle itself, then we will have to discuss how it should be applied. Perhaps it will be possible to work out a general formula that could be applied to each case involving downstream benefits. If this is found impossible, we should at least try to agree on the factors to be considered and on their relative importance. A specific formula for the allocation of downstream power would then have to be worked out in each case. There is no easy and simple solution to the problem of downstream benefits. It is only through negotiations that we can hope to find a satisfactory compromise."

The preceding section, then, represents the program for the upper Columbia now under intensive study by the Government of Canada, and the Canadian position in the negotiations pending in the International Joint Commission. The next section will review some of the available statements indicating the position of our Government in these negotiations.

THE UNITED STATES POSITION IN THE INTERNATIONAL JOINT COMMISSION

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In summary, our representative (Mr. Jordan) seems to be telling the Canadians (1) that diversion of Kootenay and Columbia River water stored in Canadian reservoirs for downstream utilization on the Fraser River will be resisted as an invasion of United States appropriations of the flows of these rivers and as a serious injury to the United States; (2) that we intend to develop fully the storage sites available in the Columbia Basin in the United States and to "capture for these projects the premium power values available to 'early-added' storage"; (3) that this development in the United States will make progressively less valuable to us the storage potential in the Canadian part of the basin; and (4) that we expect that the addition of steam generation to the Pacific Northwest power system will, in the foreseeable future, cause Canadian storage to be of no substantial advantage to the United States.

This analysis is founded on the conclusions of a special interagency study, United States and Canadian Storage Projects, Columbia River and Tributaries, prepared last winter by the Bonneville Power Administration, the Bureau of Reclamation, the Geological Survey, the Federal Power Commission, and the United States Army Corps of Engineers. A summary report on this study, published April 15, 1955, is available in the files of the committee.

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The engineering aspects of this analysis are obviously beyond the scope of my present report. However, the Senate Interior Committee, in its own study of Canadian storage in the Columbia River system, may well want to examine the stated assumptions of this engineering analysis, which have been quoted above.

These assumptions include "Clark Fork Basin storage equivalent to Glacier View and Paradise projects"—4 million acre-feet—but such storage at the Glacier View project cannot be obtained without flooding scenic areas of Glacier National Park, which will be determinedly opposed by millions of Americans intent on preventing impairment of the unique and irreplaceable beauty of our national park system. The Paradise project is controversial because it would imperil rich irrigated farmlands, major transportation arteries, and Indian lands. And to date there is no assurance that 4 million acre-feet of storage "equivalent" to these projects can in fact be found in the Clark Fork Basin.

Similarly, the proposed projects at Penny Cliffs and Bruces Eddy on the Clearwater River would destroy valuable salmon and steelhead spawning grounds and flood out the elk feeding grounds along the Lochsa River as well as portions of the Selway-Bitterroot wilderness area.

Such invasion of scenic regions is certain to meet the same objections from conservation groups that recently forced the administration to abandon the Echo Park project in Utah.

Finally, the interagency study assumes 2,300,000 acre-feet of storage on the "Middle Snake." The Federal Hells Canyon projects, authorization of which is sought by 30 United States Senators in S. 1333, would provide 4 million acre-feet of storage. But the administration and the Federal Power Commission have abandoned this stretch of the Snake River to partial development by the Idaho Power Co., which will provide only a 1 million acre-feet reservoir at its proposed Brownlee project. Neither the study nor Governor Jordan explains where, once the great Hells Canyon Reservoir has been permanently sacrified, the assumed storage on the Middle Snake will be found.

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However, in focusing on a "long-term" analysis of storage values in the light of waterpower requirements within the United States in the next 20 years, the study assumes the subordination of all other conflicting values to hydroelectric development and ignores the question whether all physically available development in the United States will in fact be undertaken. In the words of the summary report, "Policy being beyond its scope, this report considers only engineering aspects. * * *" But policy as well as engineering feasibility must be reflected in our attitude toward Canadian storage and the best timing of its development in coordination with our own.

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Fisheries endangered by proposed diversion

This section of my report would not be complete without a reference to the adverse impact which the construction of large dams on the Fraser River would have on one of the major fisheries resources of the continent—the great sockeye salmon runs of the Fraser River system. The danger to these salmon runs has been raised in opposition to the Fraser diversion studies of the Canadian Government both by proponents of these fisheries in the parliamentary debate of the special appropriation for those studies and by Governor Jordan in the International Joint Commission.

At one time, the Fraser River had produced 2,390,000 cases of salmon; but after a disastrous landslide, triggered by railroad construction in the canyon, virtually blocked the river in 1913, the run dwindled to less than 150,000 cases. Tunnels, fish ladders, and other ingenious devices installed by the International Fisheries Commission, supported jointly by the United States and Canada, eventually succeeded in enabling anadromous fish to return upstream to spawn. The sockeye restoration has been phenomenal—a fish pack which had all but disappeared suddenly was worth $33 million in 1954.

If a series of dams of considerable height were built on the Fraser River to utilize diversion of a substantial portion of the Columbia River's flow into the Fraser's watershed, biologists agree that this would inevitably have a profound effect upon these sockeye runs, which have been so successfully restored by joint United States-Canadian efforts. Both Nations have a stake in this resource, because the Fraser River sockeye migration, discharging into the straits north of Puget Sound, is shared by commercial fishermen flying the flags of the United States and Canada.

Another danger to the salmon fisheries lies in the fact that the water of the upper Columbia River—although itself blocked to salmon by the lofty barrier at Grand Coulee—continues to furnish a portion of the habitat for the salmon runs farther downstream, even those which turn up the Snake River on their way to spawn in the secluded Salmon River of Idaho. Engineers and fisheries experts have expressed apprehension that diversion of 25 percent of the upper Columbia River could raise the temperature of the lower river enough to endanger the health and vitality of migratory salmon.

Finally, diversion of stored Canadian flows would increase the pressure for the development of storage within the United States portion of the Columbia Basin, even at the cost of sacrificing irreplaceable salmon and steelhead runs which spawn in such rivers as the Salmon and Clearwater.

It is of obvious importance that these unfavorable consequences of the proposed diversion be given full consideration by both the Canadian and the United States Governments in weighing the value to both Nations of an agreed program of upstream development which would utilize the full flow of the Columbia River in its present channel.

Issues for Congressional Inquiry and Action

In the preceding section I have sought to indicate, insofar as possible from the public materials which have come to my attention in the course of this study, some of the considerations which have been expressed in formulating the United States approach to Canadian storage possibilities. To be fair to Mr. Jordan and his advisers, I have quoted at length the most significant parts of his own statements of this approach. But from these public records alone, it would be difficult to discover a comprehensive United States policy toward the question of the manner in which the upper reaches of the Columbia River system which are in Canadian custody should best be utilized.

Nor is it enough to have the most complete engineering data from which to evolve a negotiating position, if the presentation of that position is not motivated by and does not reflect a strong determination of the responsible officials of the United States Government to reach agreement on a rational and practical program for the river basin.

I do not at this time intend to attack, in my present report, the policy which may have been adopted for our negotiations with Canada. I do recommend that the Senate Committee on Interior and Insular Affairs schedule public hearings to find out whether a policy has, in fact, been adopted; if so, by whom, and what it is; whether that policy and the manner of its presentation are designed to assure the earliest possible agreement on coordinating Canadian developments in the Columbia River system and our own; and, finally, how we should take account of future Canadian developments in acting on our own program for the water resources of the Columbia River Basin.

Responsibility within United States Government for negotiating future of Columbia River with Canada

Should the fate of the Columbia River be left wholly in the hands of a political appointee to an "advisory" commission, a post without Senate confirmation, who has long been an avowed enemy of the Federal program of development of the Columbia River Basin? Are we jeopardizing our friendly relations with Canada over this issue by entrusting them to a spokesman for the United States who does not consider partisan political attacks on supporters of the Federal program inconsistent with his role as the American representative in international negotiations for the future of that program?

Within our own national administration, there is little evidence of policy formulation or public discussion outside of the statements of Chairman Jordan, of the United States section of the International Joint Commission, who seems to have been left fully in charge of negotiations which—if mishandled—may forever lose for the United States all presently unutilized flows of the Kootenay and Columbia Rivers, and cause a bitter controversy with our Canadian allies.

Governor Jordan has frequently boasted of his long record of opposition to the Federal program for the Columbia River system. His first official visit to Washington, D. C., as Governor of Idaho was for the purpose of opposing authorization of a Federal dam at Hells Canyon, and he subsequently testified against this key storage project before the House Subcommittee on Irrigation and Reclamation. He has attacked the Bonneville Power Administration as a scheme to "take over" the Northwest region.

Mr. Jordan's antagonism extends not only to the Federal program but to all public power. He has fought against the public preference clause which, since the original Reclamation Act of 1906, has been a traditional feature of Federal projects. As early as 1951, he said in a speech in Portland, Oreg., that the time has come "to stop Federal Government expansion in the region until all avenues of development by private enterprise have been fully explored."

As his device for ending Federal development in the Pacific Northwest, he chose to push for a loose interstate organization. Of this proposal, the Republican Portland Oregonian wrote: "Governor Jordan and other interests in Idaho have consistently opposed 'big' projects—especially 'big' hydroelectric projects—such as only the Federal Treasury can finance. They would substitute a smaller scale development of the resources of their State and of the Columbia Basin." In his recent public addresses, Mr. Jordan has repeatedly gone out of his way to urge the deauthorization of Federal multipurpose projects already authorized by Congress for Federal construction, so that they may be turned into "partnership" dams of which private power companies would be the special beneficiaries.

The quotations from Governor Jordan's statements in the preceding section have shown the emphasis he consistently places on the eventual role of steam

generation in planning the future power supply of the Pacific Northwest—the region which still holds 40 percent of the undeveloped hydroelectric potential of the United States. To bolster his less-than-enthusiastic approach to water-power development, Governor Jordan relies upon and quotes another long-standing opponent of the Federal program, Mr. Holland Houston, whose testimony in power matters has repeatedly been discredited by the most competent experts in the Federal Government, including the staff of the Federal Power Commission. In its hearings into the Canadian storage problems, the committee would be well advised to look into the role which Mr. Houston plays in shaping the national and international program for the Columbia River of the United States Government, with which he has, to my knowledge, no official connection.

It is easy to see how a bias for the private electric companies and against the Federal Bonneville system and its community-owned public-preference customers could let one face with indifference the substitution of steam-generated power for upstream storage which could add millions of kilowatts to the Bonneville public-preference power supply. Governor Jordan's and Mr. Houston's constant emphasis on steam-powered generating plants as a central feature of American plans for the future electric power supply of the Pacific Northwest is hardly designed to contribute to early agreement on Canadian storage. On the one hand, it is likely to encourage the Canadians in their extreme assessment of the value of upstream storage as equivalent to the cost of steam generation. On the other hand, it must tend to convince the Canadians that the United States cares little about the storage Canada can offer on the upper Columbia River, and that they had better plan for its best possible utilization by diversion within Canada.

Governor Jordan has expressed his opposition to the Federal program for the Columbia River system in many recent statements. But his most explicit and intemperate attack on this program is contained in a speech he made in Salem, Oreg., as recently as November 15, 1955—actually after the completion of my study of the subject matter of the present report to the Senate Interior Committee. In this speech, Mr. Jordan undertook a highly partisan defense of the supposed advantages of the administration's so-called partnership policy over the Federal program of comprehensive development of the Columbia River system which preceded it. This is how he described that Federal program:

"But before we discuss the policy of the present administration, let us have a look at the water resource picture of 1953 when the new administration moved in.

"For 20 years, first in the Tennessee Valley and later in the Pacific Northwest, we had drifted—and at times almost galloped—toward a Federal monopoly in water-resource development—toward a philosophy that the Federal Government has an obligation to supply the electric power for these regions * * *.

"History has demonstrated that in these areas where the Federal monopoly exists, the region lives from one crisis to another, from one power shortage to another, depending on the whims of an always reluctant Congress to provide money for additional power. Such areas live in a perennial power shortage."

Governor Jordan failed to mention that, in the Pacific Northwest, where Bonneville power provides a low-cost yardstick for rates, average per capita annual consumption is over 6,000 kilowatt-hours as compared with the national average of 2,549 kilowatt-hours. At the rates prevailing elsewhere, the Pacific Northwest, too, could have a power surplus.

Governor Jordan's attack on the Federal program for developing the Columbia River system does not stop with such misrepresentations of the outstanding success of that program; it extends to those individuals who support a resumption of that program. The efforts of the proponents of Federal development—who happen to include both United States Senators from each of the three Northwest States of Montana, Washington, and Oregon, as well as, for instance, the 24 other Senate cosponsors of the Hells Canyon bill—Mr. Jordan calls "another case of political sophistry that we could pass off for the fraud that it is if it were not for the very serious effect that these tactics of delay and obstruction have on the orderly development of our water resources. * * *

"Personally, I question the sincerity of those who continually carp about the administration's 'partnership' program and at the same time have no solution to offer except Federal development or no development."

The Salt Lake Tribune of November 20, 1955, in a story by Mr. Frank Hewlett of its Washington bureau, described the speech which contained these quotes as "having reflected administration views on water and power development" and reported that Mr. Jordan "is frequently called in by the White House or his good friend Secretary of the Interior Douglas McKay to help formulate top water policy decisions."

Governor Jordan is, of course, privileged personally to oppose Hells Canyon Dam or any other part of the Federal waterpower system in the Pacific Northwest. Such an attitude, however, is not likely to lead to vigorous and effective pursuit of a formula for developing Canadian storage reservoirs to increase by millions of kilowatts the capacity of that Federal system. Members of this committee may find it interesting to contrast Governor Jordan's statement of administration waterpower policy for the Columbia Basin with the enthusiastic and optimistic statements of Canadian leaders looking forward to the maximum low-cost power development of their section of the basin, which have been quoted earlier in my report.

It is doubtful if a single Senator can fruitfully engage in public "second guessing" of the American position in delicate international negotiations while they are in progress, and it is not my purpose in this report to criticize any specific representations of United States views which Governor Jordan may have made in the International Joint Commission.

I do believe, however, that the Senate Committee on Interior and Insular Affairs can and should demand from the responsible policymaking officials of the administration the kind of thorough and comprehensive public explanation of the American position which the Canadian Government has given its Parliament and public. And in the course of these hearings, I believe that the committee should consider whether the manner in which the American program is now being formulated and presented is commensurate with the importance of the issues at stake. My own substantive recommendations for consideration at the hearing are:

1. That responsibility within the United States Government for these important negotiations be raised from the level of a purely advisory committee like the United States section of the International Joint Commission and be explicitly assumed by the policymaking executive departments themselves.

2. That as long as United States members of the International Joint Commission are to play roles at least comparable to those of senior officers in the Foreign Service, their appointment be made subject to confirmation by the United States Senate.

3. That in its hearings, this committee thoroughly examine the past and recent statements by Governor Jordan on river development, with a view to determining if his profound bias and prejudice on issues of Federal power policy disqualifies him from representing us in seeking further capacity for downstream Federal projects in the United States.

A program for progress in Columbia River Basin development

The hearings which I urge this committee to hold should also assist toward the formulation of an affirmative national policy of development for the Columbia River Basin.

The Libby project, with its 5 million acre-feet of live storage and its installation of 800,000-kilowatt capacity at the site, is one of the key storage and power projects in the entire Columbia River Basin. Already authorized by Congress, it is one of the few known to be ready for early construction.

Throughout the preelection season of 1954, Secretary of the Interior Douglas McKay and other political spokesmen for the administration claimed Libby as the administration's next great project for the Northwest. Yet the Libby project cannot be built without Canadian consent. And we have seen that our Canadian neighbors will not authorize a large part of the Libby Reservoir on in Kootenai in British Columbia as long as disagreement over the principle of downstream benefits may require them to divert Kootenai and Columbia River flows to their own use within Canda. Thus, this committee should ask Secretary McKay and other responsible administration officials to explain their plans for reaching the agreement with Canada necessary for an early start on this crucial project.

At the same time, we must proceed with the best possible development of storage and other projects within the United States to utilize the full flows of the Columbia River and its tributaries.

On September 21, 1955, the United States Board of Engineers for Rivers and Harbors decided that the pool level elevation of the planned John Day Dam project on the Columbia River could not be reduced from 292 feet to 265 feet, because this would lose us 1,500,00 acre-feet of flood-control storage needed for the main control plan for the Columbia, which could not be recovered at any other known site in the United States. (Note that as far downstream as John Day,

this storage does not offer a fraction of the power benefits of an equivalent amount of storage in the upper reaches of the Columbia River system.) Yet, at the same time, this administration has irresponsibly abandoned 3 million acre-feet of flood control and power-producing storage at Hells Canyon.

Governor Jordan cites hypothetical future United States projects of the equally hypothetical C level of development of the Columbia system to prove the diminishing downstream value of Canadian upstream storage. But it has become a familiar technique to delay and obstruct the construction of any one project actually under consideration by proving its lesser value for flood control and downstream power if other projects were also added to the system.

Thus, the administration speaks of millions of acre-feet of future storage at controversial sites within the United States where reservoirs would block off valuable Chinook salmon runs or flood national parks, or elk refuges, or fertile farmlands. But it continues to thwart authorization of the great Hells Canyon project, where the only source of controversy is the desire of a private utility company to control the Snake River for its profitable high-cost, partial developments.

By the same technique, Governor Jordan can show that construction of the huge Mica project in Canada will not, in the long run, be of great value to the United States. Yet the tangible and intangible values of commercial and sports fisheries and wildlife and recreational uses must be weighed along with hypothetical power benefits in comparing Canadian and United States storage possibilities. For example, the upper Columbia River has already been eliminated as a spawning area for migratory fish; and any storage benefits attained above Grand Coulee could serve to relieve the pressure on such canyon-bound American rivers as the Salmon and Clearwater, where fisheries and other wildlife are still a decisive factor. Conversely, the loss to the lower Columbia Basin of upstream Canadian storage will put these rivers into greater jeopardy.

In the Salmon River watershed of Idaho spawn approximately 60 percent of the valuable spring salmon runs of the Columbia Basin, and the Clearwater is not only host to steelhead trout, but also contains in its drainage important recreational values which would be disturbed by dam construction. The objections of fishing and outdoor groups demonstrate that Governor Jordan and the administration cannot cavalierly dismiss the value of Canadian storage on the assumption that storage on these United States rivers will be developed first.

Certainly, agreement between the United States and Canada on the construction of this and other Canadian storage projects must be flexible enough to allow for expected future developments on both sides of the boundary. But Mica is the key to the development of the Columbia River in Canada.

Without Mica, downstream development in Canada may not be feasible. Construction of Mica, in turn, will be justified, in part, by downstream benefits from the controlled release of its storage—whether on the Columbia River in Canada and the United States or on the Fraser River, wholly in Canada. And Mica is ready for construction in the immediate future. It could be built now to benefit the whole Columbia River Basin—or it could be delayed by failure to pursue speedy agreement until Canada might carry through the diversion schemes now under study, to the irreparable loss of the United States.

Accordingly, I submit the following additional substantive recommendations for the committee's consideration:

4. That this committee recognize as an important objective of negotiations with Canada the urgent need for upstream storage to provide effective flood control for the Columbia River farther downstream, particularly in view of the present administration's irresponsible abandonment of great floodwater storage reservoirs such as Hells Canyon on the Snake River, the main tributary of the Columbia in the United States.

5. That pending the active pursuit of agreement with Canada on the development of the upper Columbia River, the Congress act wisely and promptly to preserve for early Federal development the upstream storage sites in the Columbia River Basin within the United States. Especially it would be an unconscionable tragedy to sacrifice forever, in return for the small 1 million acre-feet private project favored by the present administration, the 4 million acre-feet of invaluable storage at Hells Canyon, wholly within the United States, while the storage potential of the upper Columbia is in danger of being forever lost to the United States through diversion into the Fraser River, wholly within Canada.

6. That this committee express its firm intent that, in our negotiations with Canada, no effort be spared to arrive at the best possible program for

the development of the upper Columbia River—beginning now with the construction of the Libby and Mica projects—so as to maximize the mutual benefits to both countries which share this unique resource. Such a determined and constructive effort must give frank and openminded consideration to the fair allocation of upstream costs and downstream benefits attributable to upstream storage—including possible sharing of benefits in generated electric power.

In concluding my report, I want to stress to this committee my personal conviction that, with an earnest and openminded effort on both sides, we can agree with Canada on a program to make the best use of our great jointly held water resources in their present channels. I stated in the introduction that failure to reach agreement on a mutually beneficial program for developing the Columbia River would threaten the gravest crisis in modern United States-Canadian relations, as well as incalculable economic loss to both countries. Agreement and execution of such a program, on the other hand, can assure economic progress for generations to come for the Pacific Northwest in both countries, and make a material contribution to the industrial and defensive strength of the North American Continent and the western alliance. The United States Senate Committee on Interior and Insular Affairs can and should play a great role in assuring the early attainment of this vital goal.

(Treaty series, No. 548)

BOUNDARY WATERS AND QUESTIONS ARISING ALONG THE BOUNDARY BETWEEN THE UNITED STATES OF AMERICA AND CANADA

TREATY BETWEEN THE UNITED STATES OF AMERICA AND GREAT BRITAIN

Signed at Washington, January 11, 1909.
Ratification advised by the Senate of the United States, with understanding, March 3, 1909.
Ratified by the President of the United States, April 1, 1910.
Ratified by Great Britain, March 31, 1910.
Ratifications exchanged at Washington, May 5, 1910.
Proclaimed by the President of the United States, May 13, 1910.

BY THE PRESIDENT OF THE UNITED STATES OF AMERICA.

A PROCLAMATION.

WHEREAS a Treaty between the United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, was concluded and signed by their respective Plenipotentiaries at Washington on the eleventh day of January, one thousand nine hundred and nine, the original of which Treaty is word for word as follows:

The United States of America and His Majesty the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, being equally desirous to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and the Dominion of Canada involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise, have resolved to conclude a treaty in furtherance of these ends, and for that purpose have appointed as their respective plenipotentiaries:

The President of the United States of America, Elihu Root, Secretary of State of the United States; and

His Britannic Majesty, the Right Honorable James Bryce, O. M., his Ambassador Extraordinary and Plenipotentiary at Washington;

Who, after having communicated to one another their full powers, found in good and due form, have agreed upon the following articles:

PRELIMINARY ARTICLE.

For the purposes of this treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms, and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers, and waterways, or waters flowing from such lakes, rivers, and waterways, or the waters of rivers flowing across the boundary.

ARTICLE I.

The High Contracting Parties agree that navigation of all navigable boundary waters shall forever continue free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation and applying equally and without discrimination to the inhabitants, ships, vessels, and boats of both countries.

It is further agreed that so long as this treaty shall remain in force, this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters, and now existing or which may hereafter be constructed on either side of the line. Either of the High Contracting Parties may adopt rules and regulations governing the use of such canals within its own territory and may charge tolls for use thereof, but all such rules and regulations and all tolls charged shall apply alike to the subjects or citizens of the High Contracting Parties and the ships, vessels, and boats of both of the High Contracting Parties, and they shall be placed on terms of equality in the use thereof.

ARTICLE II.

Each of the High Contracting Parties reserves to itself or to the several State Governments on the one side and the Dominion or Provincial Governments on the other as the case may be, subject to any treaty provisions now existing with respect thereto, the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; but this provision shall not apply to cases already existing or to cases expressly covered by special agreement between the parties hereto.

It is understood, however, that neither of the High Contracting Parties intends by the foregoing provision to surrender any right, which it may have, to object to any interference with or diversions of waters on the other side of the boundary the effect of which would be productive of material injury to the navigation interests on its own side of the boundary.

ARTICLE III.

It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the Parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry

on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbors, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes.

ARTICLE IV.

The High Contracting Parties agree that, except in cases provided for by special agreement between them, they will not permit the construction or maintenance on their respective sides of the boundary of any remedial or protective works or any dams or other obstructions in waters flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary unless the construction or maintenance thereof is approved by the aforesaid International Joint Commission.

It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.

ARTICLE V.[1]

The High Contracting Parties agree that it is expedient to limit the diversion of waters from the Niagara River so that the level of Lake Erie and the flow of the stream shall not be appreciably affected. It is the desire of both Parties to accomplish this object with the least possible injury to investments which have already been made in the construction of power plants on the United States side of the river under grants of authority from the State of New York, and on the Canadian side of the river under licenses authorized by the Dominion of Canada and the Province of Ontario.

So long as this treaty shall remain in force, no diversion of the waters of the Niagara River above the Falls from the natural course and stream thereof shall be permitted except for the purposes and to the extent hereinafter provided.

The United States may authorize and permit the diversion within the State of New York of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of twenty thousand cubic feet of water per second.

The United Kingdom, by the Dominion of Canada, or the Province of Ontario, may authorize and permit the diversion within the Province of Ontario of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of thirty-six thousand cubic feet of water per second.

The prohibitions of this article shall not apply to the diversion of water for sanitary or domestic purposes, or for the service of canals for the purposes of navigation.

ARTICLE VI.

The High Contracting Parties agree that the St. Mary and Milk Rivers and their tributaries (in the State of Montana and the Provinces of Alberta and Saskatchewan) are to be treated as one stream for the purposes of irrigation and power, and the waters thereof shall be apportioned equally between the two countries, but in making such equal apportionment more than half may be taken from one river and less than half from the other by either country so as to afford a more beneficial use to each. It is further agreed that in the division of such waters during the irrigation season, between the 1st of April and 31st of October, inclusive, annually, the United States is entitled to a prior appropriation of 500 cubic feet per second of the waters of the Milk River, or so much of such amount as constitutes three-fourths of its natural flow, and that Canada is entitled to a prior appropriation of 500 cubic feet per second of the flow of St. Mary River, or so much of such amount as constitutes three-fourths of its natural flow.

The channel of the Milk River in Canada may be used at the convenience of the United States for the conveyance, while passing through Canadian territory.

[1] See note on back of title page.

of waters diverted from the St. Mary River. The provisions of Article II of this treaty shall apply to any injury resulting to property in Canada from the conveyance of such waters through the Milk River.

The measurement and apportionment of the water to be used by each country shall from time to time be made jointly by the properly constituted reclamation officers of the United States and the properly constituted irrigation officers of His Majesty under the direction of the International Joint Commission.

ARTICLE VII.

The High Contracting Parties agree to establish and maintain an International Joint Commission of the United States and Canada composed of six commissioners, three on the part of the United States appointed by the President thereof, and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada.

ARTICLE VIII.

This International Joint Commission shall have jurisdiction over and shall pass upon all cases involving the use or obstruction or diversion of the waters with respect to which under Articles III and IV of this treaty the approval of this Commission is required, and in passing upon such cases the Commission shall be governed by the following rules or principles which are adopted by the High Contracting Parties for this purpose:

The High Contracting Parties shall have, each on its own side of the boundary, equal and similar rights in the use of the waters hereinbefore defined as boundary waters.

The following order of precedence shall be observed among the various uses enumerated hereinafter for these waters, and no use shall be permitted which tends materially to conflict with or restrain any other use which is given preference over it in this order of precedence:

(1) Uses for domestic and sanitary purposes;

(2) Uses for navigation, including the service of canals for the purposes of navigation;

(3) Uses for power and for irrigation purposes.

The foregoing provisions shall not apply to or disturb any existing uses of boundary waters on either side of the boundary.

The requirement for an equal division may in the discretion of the Commission be suspended in cases of temporary diversions along boundary waters at points where such equal division can not be made advantageously on account of local conditions, and where such diversion does not diminish elsewhere the amount available for use on the other side.

The Commission in its discretion may make its approval in any case conditional upon the construction of remedial or protective works to compensate so far as possible for the particular use or diversion proposed, and in such cases may require that suitable and adequate provision, approved by the Commission, be made for the protection and indemnity against injury of any interests on either side of the boundary.

In cases involving the elevation of the natural level of waters on either side of the line as a result of the construction or maintenance on the other side of remedial or protective works or dams or other obstructions in boundary waters or in waters flowing therefrom or in waters below the boundary in rivers flowing across the boundary, the Commission shall require, as a condition of its approval thereof, that suitable and adequate provision, approved by it, be made for the protection and indemnity of all interests on the other side of the line which may be injured thereby.

The majority of the Commissioners shall have power to render a decision. In case the Commission is evenly divided upon any question or matter presented to it for decision, separate reports shall be made by the Commissioners on each side to their own Government. The High Contracting Parties shall thereupon endeavor to agree upon an adjustment of the question or matter of difference, and if an agreement is reached between them, it shall be reduced to writing in the form of a protocol, and shall be communicated to the Commissioners, who shall take such further proceedings as may be necessary to carry out such agreement.

ARTICLE IX.

The High Contracting Parties further agree that any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along the common frontier between the United States and the Dominion of Canada, shall be referred from time to time to the International Joint Commission for examination and report, whenever either the Government of the United States or the Government of the Dominion of Canada shall request that such questions or matters of difference be so referred.

The International Joint Commission is authorized in each case so referred to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

Such reports of the Commission shall not be regarded as decisions of the questions or matters so submitted either on the facts or the law, and shall in no way have the character of an arbitral award.

The Commission shall make a joint report to both Governments in all cases in which all or a majority of the Commissioners agree, and in case of disagreement the minority may make a joint report to both Governments, or separate reports to their respective Governments.

In case the Commission is evenly divided upon any question or matter referred to it for report, separate reports shall be made by the Commissioners on each side to their own Government.

ARTICLE X.

Any questions or matters of difference arising between the High Contracting Parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada either in relation to each other or to their respective inhabitants, may be referred for decision to the International Joint Commission by the consent of the two Parties, it being understood that on the part of the United States any such action will be by and with the advice and consent of the Senate, and on the part of His Majesty's Government with the consent of the Governor General in Council. In each case so referred, the said Commission is authorized to examine into and report upon the facts and circumstances of the particular questions and matters referred to, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.

A majority of the said Commission shall have power to render a decision or finding upon any of the questions or matters so referred.

If the said Commission is equally divided or otherwise unable to render a decision or finding as to any questions or matters so referred, it shall be the duty of the Commissioners to make a joint report to both Governments, or separate reports to their respective Governments, showing the different conclusions arrived at with regard to the matters or questions so referred, which questions or matters shall thereupon be referred for decision by the High Contracting Parties to an umpire chosen in accordance with the procedure prescribed in the fourth, fifth, and sixth paragraphs of Article XLV of The Hague Convention for the pacific settlement of international disputes, dated October 18, 1907. Such umpire shall have power to render a final decision with respect to those matters and questions so referred on which the Commission failed to agree.

ARTICLE XI.

A duplicate original of all decisions rendered and joint reports made by the Commission shall be transmitted to and filed with the Secretary of State of the United States and the Governor General of the Dominion of Canada, and to them shall be addressed all communications of the Commission.

ARTICLE XII.

The International Joint Commission shall meet and organize at Washington promptly after the members thereof are appointed, and when organized the Commission may fix such times and places for its meetings as may be necessary, subject at all times to special call or direction by the two Governments. Each

Commissioner, upon the first joint meeting of the Commission after his appointment, shall, before proceeding with the work of the Commission, make and subscribe a solemn declaration in writing that he will faithfully and impartially perform the duties imposed upon him under this treaty, and such declaration shall be entered on the records of the proceedings of the Commission.

The United States and Canadian sections of the Commission may each appoint a secretary, and these shall act as joint secretaries of the Commission at its joint sessions, and the Commission may employ engineers and clerical assistants from time to time as it may deem advisable. The salaries and personal expenses of the Commission and of the secretaries shall be paid by their respective Governments, and all reasonable and necessary joint expenses of the Commission, incurred by it, shall be paid in equal moieties by the High Contracting Parties.

The Commission shall have power to administer oaths to witnesses, and to take evidence on on oath whenever deemed necessary in any proceeding, or inquiry, or matter within its jurisdiction under this treaty, and all parties interested therein shall be given convenient opportunity to be heard, and the High Contracting Parties agree to adopt such legislation as may be appropriate and necessary to give the Commission the powers above mentioned on each side of the boundary, and to provide for the issue of subpenas and for compelling the attendance of witnesses in proceedings before the Commission. The Commission may adopt such rules of procedure as shall be in accordance with justice and equity, and may make such examination in person and through agents or employees as may be deemed advisable.

ARTICLE XIII.

In all cases where special agreements between the High Contracting Parties hereto are referred to in the foregoing articles, such agreements are understood and intended to include not only direct agreements between the High Contracting Parties, but also any mutual arrangement between the United States and the Dominion of Canada expressed by concurrent or reciprocal legislation on the part of Congress and the Parliament of the Dominion.

ARTICLE XIV.

The present treaty shall be ratified by the President of the United States of America, by and with the advice and consent of the Senate thereof, and by His Britannic Majesty. The ratifications shall be exchanged at Washington as soon as possible and the treaty shall take effect on the date of the exchange of its ratifications. It shall remain in force for five years, dating from the day of exchange of ratifications, and thereafter until terminated by twelve months' written notice given by either High Contracting Party to the other.

IN FAITH WHEREOF the respective plenipotentiaries have signed this treaty in duplicate and have hereunto affixed their seals.

DONE at Washington the 11th day of January, in the year of our Lord one thousand nine hundred and nine.

ELIHU ROOT [SEAL]
JAMES BRYCE [SEAL]

AND WHEREAS the Senate of the United States by their resolution of March 3, 1909, (two-thirds of the Senators present concurring therein) did advise and consent to the ratification of the said Treaty with the following understanding, to wit:

"*Resolved further, as a part of this ratification*, That the United States approves this treaty with the understanding that nothing in this treaty shall be construed as affecting, or changing, any existing territorial or riparian rights in the water, or rights of the owners of lands under water, on either side of the international boundary at the rapids of the St. Mary's river at Sault Ste. Marie, in the use of the waters flowing over such lands, subject to the requirements of navigation in boundary waters and of navigation canals, and without prejudice to the existing right of the United States and Canada, each to use the waters of the St. Mary's river, within its own territory, and further, that nothing in this treaty shall be construed to interfere with the drainage of wet swamp and overflowed lands into streams flowing into boundary waters, and that this interpretation will be mentioned in the ratification of this treaty as conveying the true meaning of the treaty, and will, in effect, form part of the treaty;"

AND WHEREAS the said understanding has been accepted by the Government of Great Britain, and the ratifications of the two Governments of the said treaty were exchanged in the City of Washington, on the 5th day of May, one thousand nine hundred and ten;

NOW, THEREFORE, BE IT KNOWN THAT I, William Howard Taft, President of the United States of America, have caused the said treaty and the said understanding, as forming a part thereof, to be made public, to the end that the same and every article and clause thereof may be observed and fulfilled with good faith by the United States and the citizens thereof.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the seal of the United States to be affixed.

DONE at the City of Washington this thirteenth day of May in the year of our Lord one thousand nine hundred and ten, and of the [SEAL] Independence of the United States of America the one hundred and thirty-fourth.

WM H TAFT

By the President:
P C KNOX
Secretary of State.

PROTOCOL OF EXCHANGE[1]

On proceeding to the exchange of the ratifications of the treaty signed at Washington on January 11, 1909, between the United States and Great Britain, relating to boundary waters and questions arising along the boundary between the United States and the Dominion of Canada, the undersigned plenipotentiaries, duly authorized thereto by their respective Governments, hereby declare that nothing in this treaty shall be construed as affecting, or changing, any existing territorial, or riparian rights in the water, or rights of the owners of lands under water, on either side of the international boundary at the rapids of the St. Mary's River at Sault Ste. Marie, in the use of the waters flowing over such lands, subject to the requirements of navigation in boundary waters and of navigation canals, and without prejudice to the existing right of the United States and Canada, each to use the waters of the St. Mary's River, within its own territory; and further, that nothing in this treaty shall be construed to interfere with the drainage of wet, swamp, and overflowed lands into streams flowing into boundary waters, and also that this declaration shall be deemed to have equal force and effect as the treaty itself and to form an integral part thereto.

The exchange of ratifications then took place in the usual form.

IN WITNESS WHEREOF, they have signed the present Protocol of Exchange and have affixed their seals thereto.

DONE at Washington this 5th day of May, one thousand nine hundred and ten.

PHILANDER C KNOX [SEAL]
JAMES BRYCE [SEAL]

The official citation for this treaty
is 36 Stat. (Part 2) 2448

[Reprinted April 1953]

Paragraphs 3, 4, and 5 of Article V, page 3, terminated October 10, 1950, upon entry into force on that date of the treaty concerning the uses of the waters of the Niagara River signed at Washington February 27, 1950 (TIAS 2130: 1 UST 694).

The CHAIRMAN. Does any other Senator wish to make a statement at this time?

If there are no other statements to be made, I will call the first witness, Mr. Len Jordan, Chairman of the United States Section of the International Joint Commission.

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[1] This protocol of exchange was ratified by Great Britain June 4, 1910.

STATEMENT OF LEN JORDAN, CHAIRMAN OF THE UNITED STATES SECTION, INTERNATIONAL JOINT COMMISSION

Mr. JORDAN. Mr. Chairman and distinguished members of the joint committee, I assure you it is a pleasure for me to be here in my capacity as Chairman of the United States Section of the International Joint Commission to discuss with you some of the problems having to do with the development of the Columbia Basin and its great water resources.

Mr. Chairman, I have prepared a statement which I should like to read with your permission.

The CHAIRMAN. You may follow whatever course you desire.

Mr. JORDAN. Mr. Chairman, I should like to bring into the discussion the history of the International Joint Commission, a little of the background leading up to it.

As early as 1902, the Governments of the United States and Canada established by concurrent legislation an International Waterways Commission. This Commission, which consisted of 6 members, 3 representing the United States and 3 representing Canada, was purely an investigatory body, without any final jurisdiction. Its investigations were confined largely to the waters of the lakes and rivers whose natural outlet is the St. Lawrence River.

The International Waterways Commission submitted a number of valuable reports to the two Governments, one of which included a recommendation for the creation of a commission having wider powers than its own.

As a result of these and other suggestions, negotiations were entered into at Washington in 1907 and 1908 between the then British Ambassador to the United States, James Bryce, and the then Secretary of State, Elihu Root. These negotiations finally culminated in the treaty of January 11, 1909, which was ratified and proclaimed the following year.

The treaty, consisting of a preamble and 14 articles, provided, among other things, that the high contracting parties—

> agree to establish and maintain an International Joint Commission of the United States and Canada composed of 6 Commissioners, 3 on the part of the United States appointed by the President thereof, and 3 on the part of the United Kingdom appointed by His Majesty on the recommendation of the Governor in Council of the Dominion of Canada.

The Commission met for organization in Washington on January 10, 1912, the members having been previously appointed by their respective Governments. Permanent offices were established in Washington and Ottawa; rules of procedure were adopted which provide, among other things, that regular sessions of the Commission will be held annually at Washington beginning on the first Tuesday in April and at Ottawa beginning on the first Tuesday of October, and that special meetings may be held at such times and places as the Chairman of the two sections may determine.

The rules also provide that a majority of the Commission may conduct hearings or other proceedings regularly before it, but less than the whole number shall not proceed to consider and finally determine any matter, proceeding, or question which the treaty, either specifically or by implication, requires the Commission to decide.

The important point here is that while the Commission is composed of a United States Section and a Canadian Section, each with a Chair-

man and a Secretary, neither Section can act independently of the other on any matter coming before the Commission, which functions as a unit. That the Commission has functioned successfully since its creation some 44 years ago may be adjudged, in part at least, by the fact that during this period some 72 issues have been so dealt with as to settle them in a manner satisfactory to both countries.

As is the case with any court, the Commission cannot originate its own work. Matters come to it from one or the other or jointly from both the Governments of the United States and Canada, and from private and corporate interests in either country through their respective Governments.

The preamble of the treaty sets forth as its objects—

> to prevent disputes regarding the use of boundary waters and to settle all questions which are now pending between the United States and Canada involving the rights, obligations, or interests of either in relation to the other along their common frontier, and to make provision for the adjustment and settlement of all such questions as may hereafter arise.

The treaty is designed not merely to settle questions at issue between the two countries, but to prevent disputes.

The present membership and dates of appointment to the International Joint Commission are: For Canada, Gen. A. G. L. McNaughton, Chairman, 1949; George Spence, 1947; J. Lucien Dansereau, 1951. For the United States, Len Jordan, Chairman, 1955; Roger B. McWhorter, 1939; Eugene W. Weber, 1948. Miss E. M. Sutherland is secretary of the Canadian Section and Mr. Ames W. Williams is secretary of the United States Section.

I have previously stated that the Commission cannot originate its own work. Matters came before it in either of two ways—by application from either Government, a corporation, or an individual; and by reference jointly from the two Governments only.

In the first case, an application to the International Joint Commission is required of either Government or any party proposing to use, obstruct, or divert boundary waters on either side of the line, affecting the natural level of flows of boundary waters on the other side of the line, e. g., the St. Lawrence River power project. Likewise, an application is required to obtain approval of the construction or maintenance—

> on their respective sides of the boundary of any remedial or protective works or any dams or other obstructions in waters flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary * * *

e. g., Libby Dam.

Thus, in such cases as the St. Lawrence power project in waters forming the boundary, and Libby Dam in waters crossing the boundary:

> This International Joint Commission shall have jurisdiction over and shall pass upon all cases involving the use or obstruction or diversion of the waters with respect to which * * * the approval of this Commission is required.
>
> The High Contracting Parties shall have, each on its own side of the boundary, equal and similar rights in the waters hereinbefore defined as boundary waters.

So much for a general description of those cases which come before the Commission by application, and over which the Commission has

jurisdiction as prescribed in the treaty. In such cases the duties of the Commission are judicial in nature.

Because the Libby Dam is regarded by the United States section as a key project in the proper development of the Columbia River Basin, the following section of this report is devoted to a chronological discussion of it.

FACTS RELATING TO THE LIBBY PROJECT, KOOTENAI RIVER, MONTANA-BRITISH COLUMBIA

The Libby multiple-purpose water-control project on the Kootenai River in northwestern Montana, with the reservoir site extending into British Columbia, Canada, was authorized by Congress in the Flood Control Act of May 17, 1950.

Inasmuch as the reservoir, at maximum stage, would flood 13,480 acres of land in Canada and thus cause injury to Canadian interests, it is necessary that the International Joint Commission approve the proposed construction before the project may be built.

Consequently, the Department of State filed an application with this Commission on January 12, 1951, on behalf of the Government of the United States, setting forth the salient facts relating to the proposed Libby Dam, powerhouse, and reservoir, with the dam at the project document site, mile 212.8, about 11 miles upstream from the town of Libby, Mont., and requesting that the Commission approve the proposed construction as promptly as possible. The cost of the project was expected to be about $263 million, including interest during construction.

The Commission held public hearings on the application at Spokane, Wash., on March 12, 1951; at Nelson, British Columbia, on March 14, 1951; at Cranbrook, British Columbia, on March 16, 1951; and at Helena, Mont., on March 19, 1951. At these hearings and thereafter, very strong protests against the project were lodged with the Commission by important railroad, mining, and lumber interests.

In an effort to plan a more acceptable project, the Corps of Engineers investigated several dam sites in the 20-mile stretch of river extending upstream from the town of Libby. A site at mile 204.9, about 3 miles above Libby, was investigated with considerable thoroughness because it appeared to have greater merit than any of the other sites. Objections to the project persisted, however, until the Government of the United States, on April 8, 1953, withdrew its application.

The sites at mile 204.9 and mile 212.8 are both below the mouth of Fisher River, a tributary of the Kootenai River, whereas the interests objecting to the project insisted that the dam, if constructed at all, should be located above the mouth of Fisher River because the adverse effects upon their properties and operations would then not then be so serious. The Corps of Engineers then made a careful investigation of a dam site at mile 217, about 15 miles upstream from the town of Libby and also above the mouth of Fisher River.

At an executive meeting of the Commission in Boston on January 27, 1954, the Chairman of the Canadian Section announced that the Government of Canada would explore the economic feasibility of diverting the Kootenai River to the Columbia River at Canal Flats in British Columbia. He stated that even though the United States should file a second Libby application, it would be about 4 months

before the Canadian Section would be ready to give further consideration to the matter.

At the instance of the Corps of Engineers and the Secretary of the Army, the Department of State, on May 22, 1954, filed with the Commission a second Libby application in which it was proposed that the dam and powerhouse be constructed at mile 217, the maximum reservoir level to be at elevation 2,459 feet, identically the same as was proposed in the first application.

Soon after the second Libby application was filed, the United States section of the Commission sought repeatedly to reach an agreement with the Canadian section for holding public hearings on the application, with a view to approval thereof by the Commission as soon as practicable. However, on July 7, 1954, in a statement in response to the Libby application, L. B. Pearson, Secretary of State for External Affairs, said officially for Canada:

> In response to the above-mentioned application, the Government of Canada states that it is not prepared at present either to consent to an order of approval or to oppose the granting of such an order. Sufficient data has not yet been assembled by the International Columbia River Engineering Board to make it possible to determine the most advantageous use of the waters concerned from the points of view of both countries.
>
> If in the light of such a study it is found that more advantageous use of the waters concerned could be achieved by other methods, such as a diversion of part of the waters of the Kootenai River into the Columbia River in Canada, the Canadian Government reserves the right to oppose the issuance of an order of approval in the present application.

Then, on December 20, 1954, Minister Jean Lesage, of the Canadian Department of Northern Affairs and National Resources, issued a press release announcing that his department would make—

> an investigation * * * in the summer of 1955 to determine whether it would be economically feasible to divert water from the upper Columbia River into the Fraser River system in British Columbia through tunnels to be located upstream from Revelstoke, British Columbia.

At the next semiannual meeting of the Commission in Washington on April 5, 1955, the Chairman of the Canadian section of the Commission stated for the record that a diversion of from 5,000 to 8,000 cubic feet per second of the mean flow of the Kootenai River to the Columbia River at Canal Flats, British Columbia, was under study in Canada. The average flow of this river at the international boundary, east crossing, is only about 9,500 cubic feet per second.

At the same time, the Chairman of the Canadian section stated that a diversion of some 15 million acre-feet of water per year from the Columbia River about Revelstoke to the Fraser River Basin was under consideration. Such a diversion would amount to 67.7 percent of the long-time average flow of the Columbia River at Revelstoke. He stated further that it would be some 12 or 15 months before Canada's investigation of diversions would be completed.

So far, I have discussed only that phase of International Joint Commission work which originates by virtue of specific treaty provisions outlining policy and granting jurisdiction. An equally important part of the work of the Commission originates, as provided in article IX, by specific request from the two Governments jointly with respect to particular problems of mutual concern. Such problems may or may not relate to water. The duties of the International

Joint Commission under such a request, which is known as a reference, is purely advisory in nature.

Article IX of the treaty reads as follows:

> The High Contracting Parties further agree that any other questions or matters of difference arising between them involving the rights, obligations, or interests of either in relation to the other or to the inhabitants of the other, along the common frontier between the United States and the Dominion of Canada, shall be referred from time to time to the International Joint Commission for examination and report, whenever either the Government of the United States or the Government of the Dominion of Canada shall request that such questions or matters of difference be so referred.
>
> The International Joint Commission is authorized in each case so referred to examine into and report upon the facts and circumstances of the particular questions and matters referred, together with such conclusions and recommendations as may be appropriate, subject, however, to any restrictions or exceptions which may be imposed with respect thereto by the terms of the reference.
>
> Such reports of the Commission shall not be regarded as decisions of the questions or matters so submitted either on the facts or the law, and shall in no way have the character of an arbitral award.
>
> The Commission shall make a joint report to both Governments in all cases in which all or a majority of the Commissioners agree, and in case of disagreement the minority may make a joint report to both Governments, or separate reports to their respective Governments.
>
> In case the Commission is evently divided upon any question or matter referred to it for report, separate reports shall be made by the Commissioners on each side to their own Government.

Because the Columbia River Reference of March 9, 1944, falls in this category, I shall give it next consideration.

FACTS RELATING TO THE COLUMBIA RIVER REFERENCE

Section 1 of the River and Harbor Act of January 21, 1927, directed that surveys be made of all of the more important rivers of the United States in accordance with House Document 308, 69th Congress, 1st session. Listed in that document are the streams considered worthy of comprehensive investigation with a view to their most effective improvement for purposes of navigation, in combination with the most efficient development of the potential waterpower, the control of floodwaters, and the needs of irrigation. The Columbia River system was of course included in the list.

Pursuant to the legislation cited above, the original 308 report on the Columbia River and tributaries was prepared by the Corps of Engineers, United States Army, and transmitted to the Congress by the Secretary of War in 1932. A decade later, need for revision of the report on a comprehensive scale became obvious. Consequently, the Committee on Commerce, United States Senate, adopted the following resolution on September 24, 1943:

> *Resolved by the Committee on Commerce of the United States Senate*, That the Board of Engineers for Rivers and Harbors, created under section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the reports on Columbia River and tributaries submitted under the provisions of House Document No. 308, 69th Congress, 1st session, as authorized by the River and Harbor Act of January 21, 1927, with a view to determining whether any modification of existing projects or recommended comprehensive plans of improvement should be made at this time.

The engineering studies and field investigations necessary for the review report were commenced promptly by the Corps of Engineers, with the cooperation of other interested Federal and State agencies,

and on February 14, 1950, the report requested in September 1943, a monumental work consisting of eight volumes, was transmitted to the Congress by the Secretary of the Army and published as House Document 531, 81st Congress, 2d session.

The Columbia River rises in Columbia Lake, British Columbia, on the western slope of the Rocky Mountains, and flows in a northwesterly direction about 190 miles to the mouth of Canoe River, where it makes an abrupt turn to the south, passes the city of Revelstoke, British Columbia, flows through 2 long flat-slope expansions known as Upper Arrow Lake and Lower Arrow Lake, and after being joined by 2 large tributaries—first by the Kootenay River and then by the Pend Oreille River—crosses the international boundary into the State of Washington about 10 miles below Trail, British Columbia.

The river distance from Columbia Lake to the international boundary is 460 miles. Below the boundary the river flows in a general southerly direction entirely across the eastern end of Washington, and from a point about 15 miles below the mouth of Snake River, flows westerly to the Pacific Ocean, forming the boundary between Washington and Oregon. The river distance from the International boundary to the Pacific Ocean is 750 miles, and the fall in this distance is 1,288 feet, only about 10 feet of which is below the Bonneville Dam (mile 145.3), which is at the head of tidewater.

The river drains an area of 259,000 square miles of which 39,000 square miles, or 15 percent, is in Canada. Its principal tributaries in Canada are the Kootenay and Pend Oreille Rivers; and in the United States, the Snake, Willamette, Cowlitz, Spokane, Deschutes, Lewis, Yakima, Okanogan, Wenatchee, Chelan, and John Day Rivers.

While the portion of the watershed in Canada is only 15 percent of the total, it yields about one-third of all the water which the Columbia discharges into the Pacific Ocean. About 65 percent of the flow which crosses the boundary into the State of Washington comes from the Canadian portion of the watershed.

THE COLUMBIA RIVER REFERENCE

By the time the Senate Committee on Commerce adopted its resolution of September 24, 1943, it has become apparent that, due to the rapidly increasing power requirements and other changing conditions, a general revision of the original 308 report of 1932 on the Columbia River and tributaries was imperative, and, moreover, that the review could not be accomplished in the most complete and useful manner without giving due consideration to the water resources of the Canadian portion of the watershed; but this could not be done unilaterally by the Corps of Engineers or any other agency of the United States. In this situation, an international investigation of the international aspects of the upper Columbia River Basin in Canada and the United States was patently in order.

The United States members of the International Joint Commission had for some years recognized the need for such an investigation but, of course, they could not undertake the work of their own motion. They did, however, discuss this important matter with engineer officers of the Corps of Engineers and with engineers and officials of the Department of the Interior.

Sometime prior to the year 1944, both the War Department and the Department of the Interior sent formal communications to the Secretary of State acquainting him with the situation just described, and urging him to negotiate a reference with the Government of Canada empowering the International Joint Commission to make a comprehensive investigation of the international aspects of the water resources of the upper Columbia River Basin. These suggestions were well taken, and in due course the negotiations were completed and the terms of reference agreed upon. I have supplied to your committee, Mr. Chairman, copies of the reference, dated March 9, 1944.

Work under the reference has been prosecuted diligently by the Commission and its International Columbia River Engineering Board, comprised of two United States members and two Canadian members. The Board was created by the Commission for the express purpose of directing the engineering studies and field investigations necessary to enable the Commission to prepare a complete and thoroughly adequate report to the two Governments.

Please bear in mind that in 1944, Bonneville Dam had been operating for 6 years and that Grand Coulee had been in production for 3 years. Moreover, years of work had gone into the 308 report and subsequent studies, covering in detail much of the engineering and other basic data relating to both the main stem of the Columbia River in the United States and to all of the United States tributaries of any consequence.

In contrast to the status of the investigations in the United States portion of the watershed, little was known of the water resource potential of the Canadian Columbia. The Canadian picture is best presented by Chairman McNaughton of the Canadian section of this Commission in his statement before the Standing Committee on External Affairs, House of Commons, Canada, on March 9, 1955. I quote from General McNaughton's statement:

> In Canada in 1944 our situation was far different from the well-understood and well-planned basis for expansion which had been created in the United States. We did not even have accurate topographic maps of the region on which to plan—we had only rudimentary knowledge of the runoff and levels and flows. We knew little about potential dam sites for power and storage—and less about the nature of the rock and its suitability for tunnels and foundations—we could not even say with accuracy what area would be flooded by a dam to a given crest elevation—or indeed how much water would be impounded behind it.
>
> In consequence the first thing for the Canadian Section, International Joint Commission, to do was to put in hand the investigations which would yield the information essentially required. These were in large part undertaken by what is now the Water Resources Division of the Department of Northern Affairs and National Resources.
>
> I understand the Minister has already given to the House of Commons an account of the expenditures which have been made, so I will pass directly to the results which have been obtained.
>
> This volume contains the topographic maps produced to date by the Department of Mines and Technical Surveys under arrangement made by Water Resources Division, and I am sure that if members of the committee will examine them they will agree that the product is of the highest excellence. The present state of the mapping program is depicted on the index sheet.
>
> This is all topographical information, and in addition the Water Resources Division have gathered patiently the great mass of detailed hydrological data required for an intelligent study—about precipitation in the forms of rain and snow—about evaporation and runoff—about the flow of the rivers and streams and how it varies with the seasons and from year to year—about dry periods and flood conditions, and the damage thereby caused.

Then the Mines Branch has collected the geological information which is basic to a study of possible dam sites, and the Fisheries Department have studied fish and what can be done and what must not be done if this important resource is to be maintained.

And with the agriculture experts, studies have been made of the possibilities for irrigation and so on.

We feel that about 2 more years of fieldwork lies before the various agencies, and then after that about 1½ years for the compilation, the writing, and the editing of the reports.

I call your attention to that especially, Mr. Chairman, because this statement was made just a little over a year ago, on March 9, 1955. General McNaughton expressed before the committee of the Parliament in Canada that 2 more years would be required for the completion of the engineering studies which would carry them well over into next year and that 1½ years would be required for the compilation, the writing, and the editing of the report.

We are entirely sympathetic, we in the United States Section of the International Commission, with this program. We know that it will require a substantial time for them to complete their studies. We are in sympathy with the great effort they are putting forth up there, Mr. Chairman, and in like circumstances I am sure we would require a like time, if not longer, to be sure that we evaluated all of the alternatives at our disposal for making the best use of our own resources in our own country.

We are quite sympathetic with the Canadian effort in this regard.

I took the oath of office as a Commissioner on January 7, 1955, and was elected Chairman of the United States Section on the same day. My interest in the Columbia River dates back a long time. In the college year of 1923–24 at the University of Oregon, I did extensive research toward a master's degree in economics on the subject, "The Feasibility of Barge Transportation on the Columbia River." Even though that thesis was never completed, the facts I learned in the research have served me well. My interest in the development of the Columbia has been an active and a continuing one. I have always lived in the Columbia Basin, and I have actively supported a sound program for development of the region's potential.

Moreover, I have realized for some time that integrated planning on the Columbia by both countries is essential. On April 12, 1954, when, as Governor of Idaho and chairman of the Northwest Governor's Power Policy Committee, I made a speech before the Pacific Northwest Trade Association at Portland, Oreg., I said:

I am pleased that in our Northwest Governors Power Policy Committee we have enjoyed the active participation of Canada. Not only the Province of British Columbia but Canadian utilities as well have served with us and we profit by their service. Our interests are so closely integrated that it would be folly to plan separately. Much of the ultimate success of maximum river development will depend on how well we can integrate our planning.

Adequate annual storage as close to headwaters as possible is absolutely necessary to efficient river system power production. Records indicate that about half of the annual runoff of the Columbia takes place in the 3 months of May, June, and July. Recorded flows at The Dalles show a variation of from a low of 40,000 cubic feet per second to a record high of nearly a million cubic feet per second. Several of the best storage sites are on the Canadian side. The Mica Creek site alone could store 10 million acre-feet of usable annual storage. In addition to at-site production, downstream benefits from such storage are substantial. We urgently need a cost-and-benefit allocation survey for upstream storage as an equitable basis for agreement with our Canadian

neighbors. No other single accomplishment would lend greater stimulus to river-basin progress than this.

These quotes indicate how I felt nearly 2 years ago, before I even knew there was to be a vacancy on the International Joint Commission. I have not changed my mind.

When I took office in January 1955, there was much talk about Canadian diversion schemes. Nearly a year earlier had come the Canadian proposal to investigate diversion of the Kootenai River into the Columbia, and just 2 weeks prior to my arrival in Washington to assume my new duties, the diversion studies of the Columbia to the Fraser had been given wide publicity. Thus, the record clearly shows that all Canadian diversion schemes were brought forward when I was still Governor of Idaho and therefore could not have been prompted by an attitude of mine.

Realizing that such diversions would have serious adverse effects upon existing and proposed Columbia River hydroelectric plants in the United States, we of the United States Section gave the matter our immediate attention.

Under article II of the treaty, it is clear that Canada has a right to divert the waters of the Kootenai or the Columbia with the stipulation, however, that such diversions—

from their natural channels * * * resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such interference or diversion occurs; * * *

The provisions of this section are unique in that a national of one country is permitted access to the courts of another country on an equal basis with the native citizen of that country. It may be that this provision has acted as a deterrent in years past because no major diversions that would give rise to such litigation have been made.

Conferences with many of our technical advisers disclosed the fact that the United States, one of the high contracting parties, would suffer substantial injury if full-scale diversions were carried out.

We sought clarification of article II of the treaty from counsel in the State Department, who pointed out that a similar question about clarification had been raised when the treaty was being considered by the Senate for ratification.

I quote from the memorandum from the Department of State prepared by Mr. Chandler Anderson (special counsel for the Department of State under Secretary Elihu Root and draftsman of the Boundary Waters Treaty of 1909) in reply to the objection to the ratification of the treaty between the United States and Great Britain concerning the use of the boundary waters between the United States and Canada. This memorandum was printed for the use of the Committee on Foreign Relations by the Government Printing Office, Washington, 1909. I am quoting now from the memorandum by the author or draftsman of the treaty.

(6) The right of action for damages provided for in article II applies to private or individual interests in distinction from public or governmental interests. Any question on this point is set at rest by the use of the words "injured parties." Wherever the word "party" is used in the treaty, referring to the high contracting parties, a capital P is used, so that the absence of the capital and the use of the word in the plural indicates that it can refer only to individuals.

The purpose of this provision of article II is to permit parties who are injured on the other side of the line to secure the same damages that they would be entitled to if the damage had been done within the same jurisdiction where the cause of the damage originated; but their claim is subject to the laws of the jurisdiction where the cause of the damage arises, and they must come into the courts of that jurisdiction and prove their case on exactly the same footing as if the property injured was within that jurisdiction.

PREVENTION OF DISPUTES

While the United States section of the Commission must take cognizance of the legal aspects of the possible Canadian diversions, its principal charge under the treaty is to prevent disputes between the two Governments.

With this paramount objective in mind, the United States section has diligently sought a solution within the framework of the reference of March 9, 1944.

Downstream benefits accruing from upstream storage and the value to be placed upon such benefits constitute, of course, the heart of the problem we have been considering.

Section 10 (f) of the Federal Power Act, as amended, contains a formula—that is a misstatement, Mr. Chairman; it is not a formula, it is a procedure—which is applicable to an analogous domestic situation. Insofar as Canadian storage on the Columbia River is concerned, however, this statute has no extraterritorial effect.

The Boundary Waters Treaty of 1909, which is the organic act of the International Joint Commission, unfortunately stands mute as to this important question of downstream benefits from headwater storage.

UNITED STATES STORAGE BENEFICIAL TO CANADIAN POWERPLANTS

Pertinent to the subject of downstream benefits from upstream storage is the fact that in those cases acted upon by the Commission where Canadian hydroelectric plants are the downstream beneficiaries of storage or otherwise regulated flows from the United States, no charges for such benefits, either in dollars or power, have ever been collected by the United States.

In this connection, I invite attention to the Waneta power development in Canada on the Pend Oreille River near its mouth. Several months after the first Libby application was filed, Canadian interests filed an application requesting approval of the Waneta project. Only the lowermost 16-mile stretch of the Pend Oreille is in Canada, the fall in that short distance being 425 feet. Headwater storage in the Pend Oreille Basin, aggregating 5,280,000 acre-feet, all in the United States, is of very great benefit to the Waneta plant, and will be beneficial in like manner and extent to the second Pend Oreille powerplant in Canada when it is constructed about 6 miles upstream from Waneta. The Waneta application was approved, but the United States receives no payments from the Canadian interests on account of such benefits. None was demanded or requested.

In the Lake of the Woods case, the Government of the United States entered into a convention with Canada in 1925, agreeing to the use by Canadian interests of the Lake of the Woods, a boundary water, as a storage reservoir for power purposes wholly within Canada, on

condition that a reasonable cash payment totaling about $275,000 would be made for the purpose of indemnifying injured United States interests. The point in this case is that the United States did not resort to its power to deny such storage use as leverage to exact a part of the electric power from the Canadian interests.

In the Corra Linn Dam case on the Kootenai River, Idaho-British Columbia, the United States Section of the Commission joined with the Canadian Section in adopting an order permitting Canadian interests to regulate Kootenay Lake for power production purposes, to the detriment of United States interests in Idaho. The water thus stored, amounting to some 680,000 acre-feet annually, is used through 5 Canadian hydroelectric plants on the lower Kootenay River with aggregate head of 360 feet, and is therefore very valuable to the Canadian interests. The Commission's order was conditioned upon reasonable cash payments being made to the injured parties in Idaho, such payments not being related in any way to the value of the storage to the Canadian interests. (Note: Kootenay Lake is in Canada, but when its level is raised, the Kootenai River in Idaho is also raised.)

In the Grand Coulee case, the United States was authorized by the Commission to raise slightly the water surface of the Columbia River at the boundary on condition that any Canadian interests that might be injured thereby would be indemnified adequately. The Canadian Section of the Commission made no demand for any part of the Grand Coulee power.

SPECIAL INTERAGENCY REPORT

Early in 1955 the United States Section of the International Joint Commission requested the aid of those agencies of the United States Government which, in its opinion, were deemed best equipped by reason of technical knowledge and experience to furnish assistance, namely, the Federal Power Commission, the Department of the Interior, and the Corps of Engineers, United States Army.

I might say, Mr. Chairman, that that power to request assistance of Federal agencies derives from section 5 of the Columbia River reference, which I should like to have made a part of the record, but I should like to quote its applicable part at this time. Section 5 of the Columbia River reference of March 9, 1944, states:

> 5. In the conduct of its investigation and otherwise in the performance of its duties under this reference, the Commission may utilize the services of engineers and other specially qualified personnel of the technical agencies of Canada and the United States, and will so far as possible make use of information and technical data heretofore acquired by such technical agencies or which may become available during the course of the investigation, thus avoiding duplication of effort and unnecessary expense.

We called upon them in this instance to make a study for us relating to Canadian and United States storage projects.

Displaying a commendable spirit of cooperation, these agencies brought forward a report dated April 15, 1955, copies of which have been furnished this committee.

Mr. Chairman, I should like to submit for the record a Summary Report on Special Interagency Study, United States and Canadian Storage Projects, Columbia River and Tributaries, dated April 15, 1955, prepared by the Department of the Interior and its subagencies, the Bonneville Power Administration, the Bureau of Reclamation, and

the Geological Survey, in collaboration with the Federal Power Commission and the Corps of Engineers of the United States Army.

The CHAIRMAN. Do you wish to have that printed in the record at this point or at the close of your statement?

Mr. JORDAN. At this point, if it would be agreeable.

The CHAIRMAN. Very well. It will be accepted and printed in the record at this point.

(The Columbia River reference, dated March 9, 1944, and the Summary Report on Special Interagency Study, dated April 15, 1955, follow:)

The Governments of the United States and the Dominion of Canada have submitted the following reference on the Columbia River Basin to the International Joint Commission:

MARCH 9, 1944.

In order to determine whether a greater use than is now being made of the waters of the Columbia River system would be feasible and advantageous, the Governments of the United States and Canada have agreed to refer the matter to the International Joint Commission for investigation and report pursuant to article IX of the convention concerning boundary waters between the United States and Canada, signed January 11, 1909.

2. It is desired that the Commission shall determine whether in its judgment further development of the water resources of the river basin would be practicable and in the public interest from the points of view of the two Governments, having in mind (*a*) domestic water supply and sanitation, (*b*) navigation, (*c*) efficient development of waterpower, (*d*) the control of floods, (*e*) the needs of irrigation, (*f*) reclamation of wet lands, (*g*) conservation of fish and wildlife, and (*h*) other beneficial public purposes.

3. In the event that the Commission should find that further works or projects would be feasible and desirable for one or more of the purposes indicated above, it should indicate how the interests on either side of the boundary would be benefited or adversely affected thereby, and should estimate the costs of such works or projects, including indemnification for damage to public and private property and the costs of any remedial works that may be found to be necessary, and should indicate how the costs of any projects and the amounts of any resulting damage may be apportioned between the two Governments.

4. The Commission should also investigate and report on existing dams, hydroelectric plants, navigation works, and other works or projects located within the Columbia River system insofar as such investigation and report may be germane to the subject under consideration.

5. In the conduct of its investigation and otherwise in the performance of its duties under this reference, the Commission may utilize the services of engineers and other specially qualified personnel of the technical agencies of Canada and the United States and will so far as possible make use of information and technical data heretofore acquired by such technical agencies or which may become available during the course of the investigation, thus avoiding duplication of effort and unnecessary expense.

SUMMARY REPORT ON SPECIAL INTERAGENCY STUDY, UNITED STATES AND CANADIAN STORAGE PROJECTS, COLUMBIA RIVER AND TRIBUTARIES

(Prepared by Department of Interior, Bonneville Power Administration, Bureau of Reclamation, Geological Survey—Federal Power Commission, Corps of Engineers, United States Army)

SECTION I—INTRODUCTION

1. *Preface.*—Any study of the value of proposed Canadian storage projects on the Columbia River and its tributaries requires a brief description of that river system in Canada and in the United States. Fifteen percent of the Columbia drainage area lies in Canada and 85 percent in the United States, although 36 percent of the runoff comes out of Canada (see pl. 1).

Canada.—The Columbia heads in southeastern British Columbia about 80 miles north of the United States border, flows northwesterly to a point some 225 miles

from the boundary, thence almost due south through the ribbon-like Arrow Lakes and into the United States.

Its principal Canadian tributary is the Kootenay which, too, rises in southeastern British Columbia but flows south past the head of the Columbia and enters the United States in Montana. Designated as the Kootenai, it loops through northwestern Montana and northern Idaho before reentering Canada to feed Kootenay Lake and merge with the Columbia, just downstream from Arrow Lakes.

This report considers two Canadian storage projects, Mica Creek and Arrow Lakes, in conjunction with United States alternatives and supplements. Mica Creek side is on the Columbia immediately downstream from the river's most northerly point. Arrow Lakes project would augment storage in the lakes of that name, by a Columbia River dam some 25 miles north of the United States border.

United States.—In the United States, the Columbia River system drains western Montana, most of Idaho, Washington, and Oregon, and small areas in Wyoming, Utah, and Nevada. It provides a series of excellent power and storage sites. Existing Federal projects and those under construction in the main Columbia River system (designated the initial base system) have about 11 million acre-feet of usable storage and will produce 3,735,000 kilowatts of prime power (3,470,000 kilowatts prime power delivered at market), exclusive of generation by non-Federal projects (see table 1).

The potential storage projects considered in this report as United States alternatives or supplements to Canadian storage include Libby, on the Kootenai River in Montana; Bruces Eddy and Penny Cliffs, on the north and south forks of the Clearwater River in Idaho, and Middle Snake projects between the Salmon and Weiser Rivers.

To determine the impact of these Canadian and American projects on the integrated United States system at a higher stage of development, the so-called C-level base system has been used. It assumes existence of Clark Fork basin storage equivalent to Glacier View and Paradise projects, Hungry Horse, Flathead Lake, Kootenay Lake, Albeni Falls, Grand Coulee, Penny Cliffs, Bruces Eddy, Middle Snake, Chief Joseph, Priest Rapids, Lower Snake, McNary, John Day, the Dalles and Bonneville Dams, with a total nameplate capacity of about 13 million kilowatts and about 21 million acre-feet of storage operated for power production. Table 1 compares the prime-power capability of the C–level system with that of the initial system.

TABLE 1.—*Prime-power capability of initial and C-level systems*

[Quantities in megawatts, at market [1]]

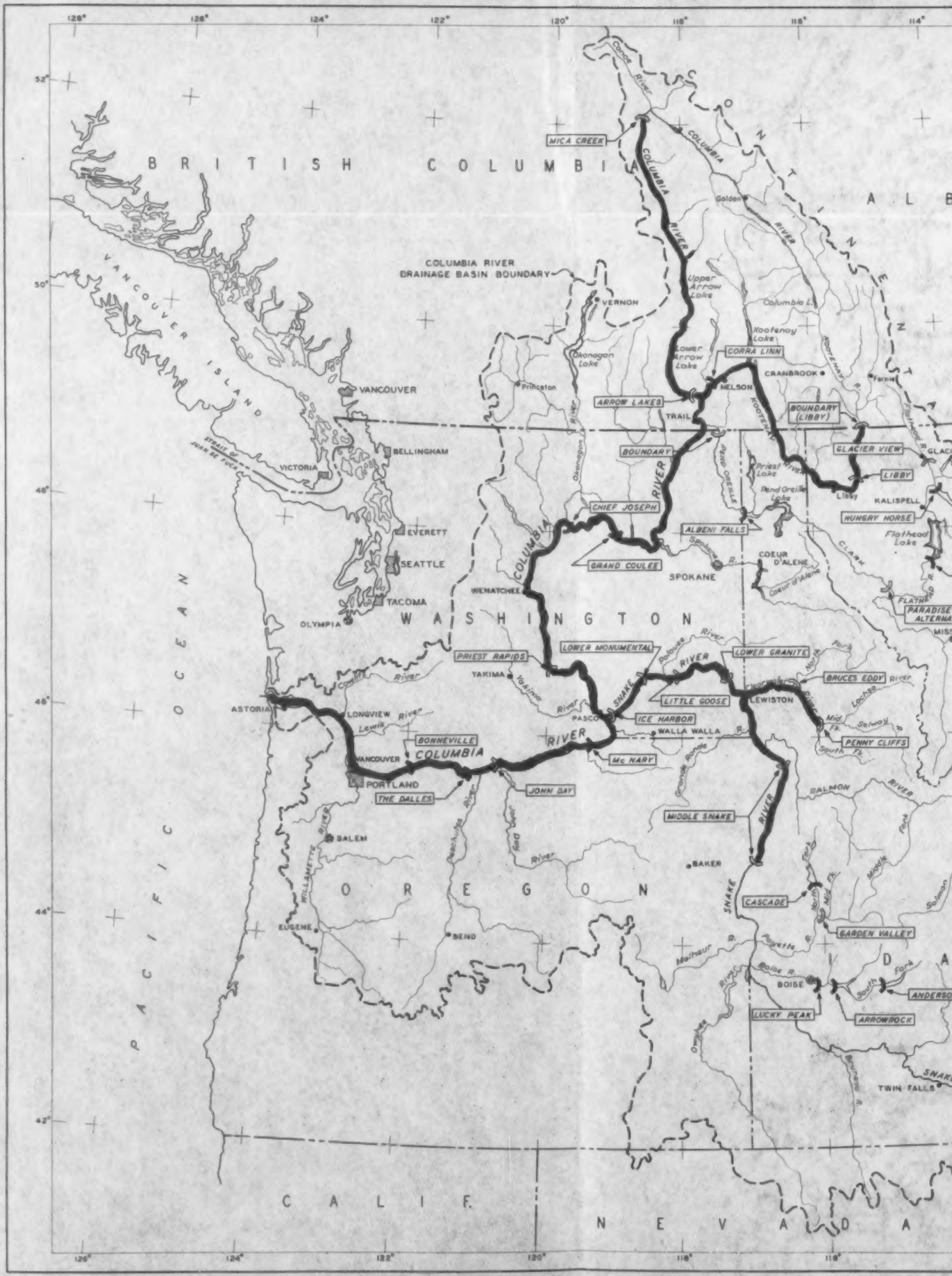
	Initial system	C-level system	Increase, initial to C-level
System total	3,474	8,140	4,666
Storage projects, at site			1,475
Downstream projects			3,191

[1] Transmission loss of 7 percent deducted from at-plant capabilities.

In order to carry these studies beyond the C-level base system, addition of steam generation sufficient to firm C-level secondary hydro power, which will be available more than 30 percent of the time, is assumed.

In any appraisal of these studies it should be held clearly in mind that the region's ability to supply power to firm loads is increased considerably by the Federal transmission grid and by regionwide, voluntary integration of both generation and transmission by all the major power producers, Federal and non-Federal. This integration is accomplished at this time under the Northwest Power Pool. Under it, energy wherever generated can be applied to load wherever located, with only minor limitations. Without such integration in the future, the generating capabilities indicated by the studies could not be realized in full.

2. *The problem.*—Each of the storage projects cited above, both Canadian and American, will increase present hydroelectric generation by stabilizing the flow of water downstream. However, as the number of upstream storage projects



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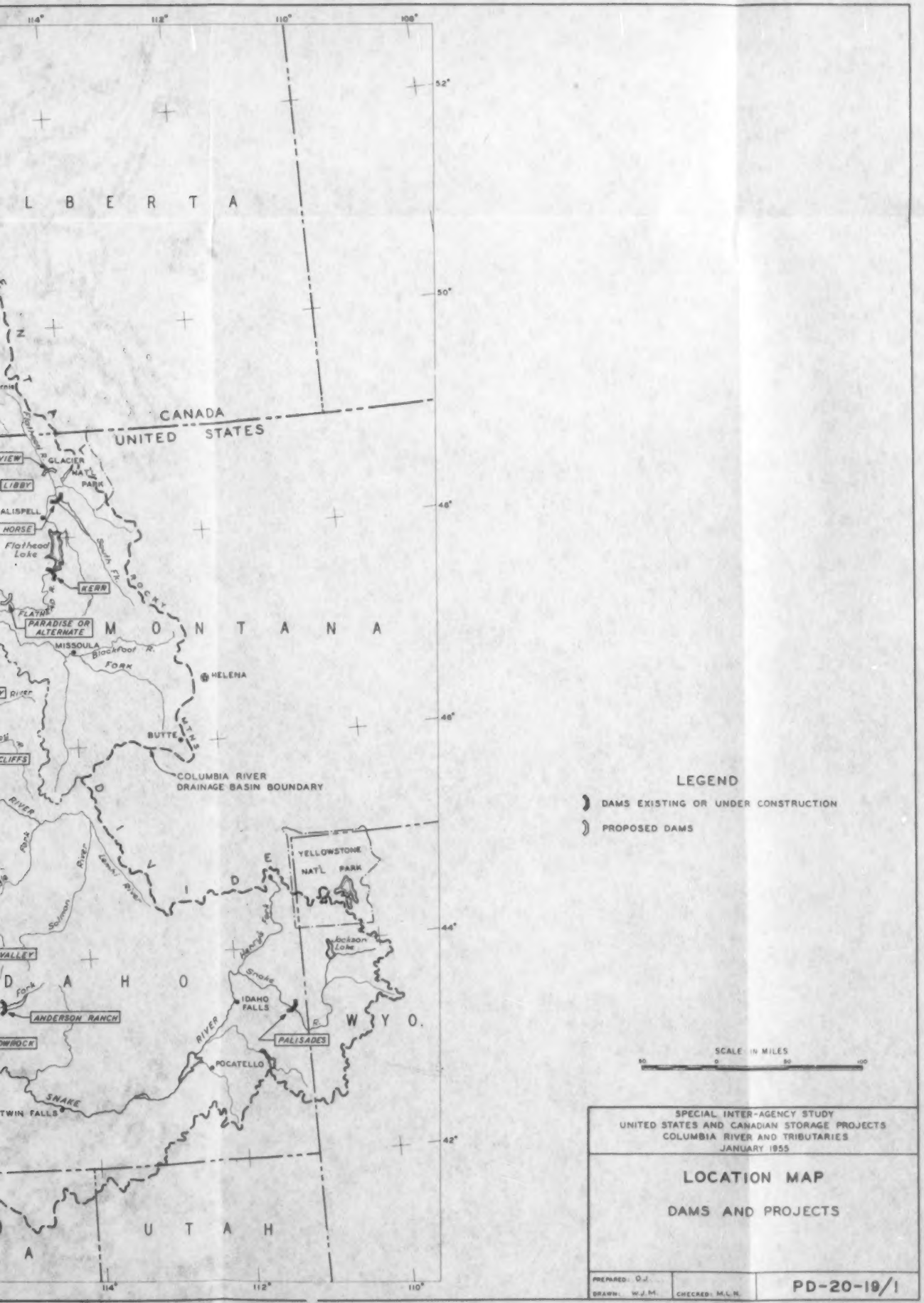


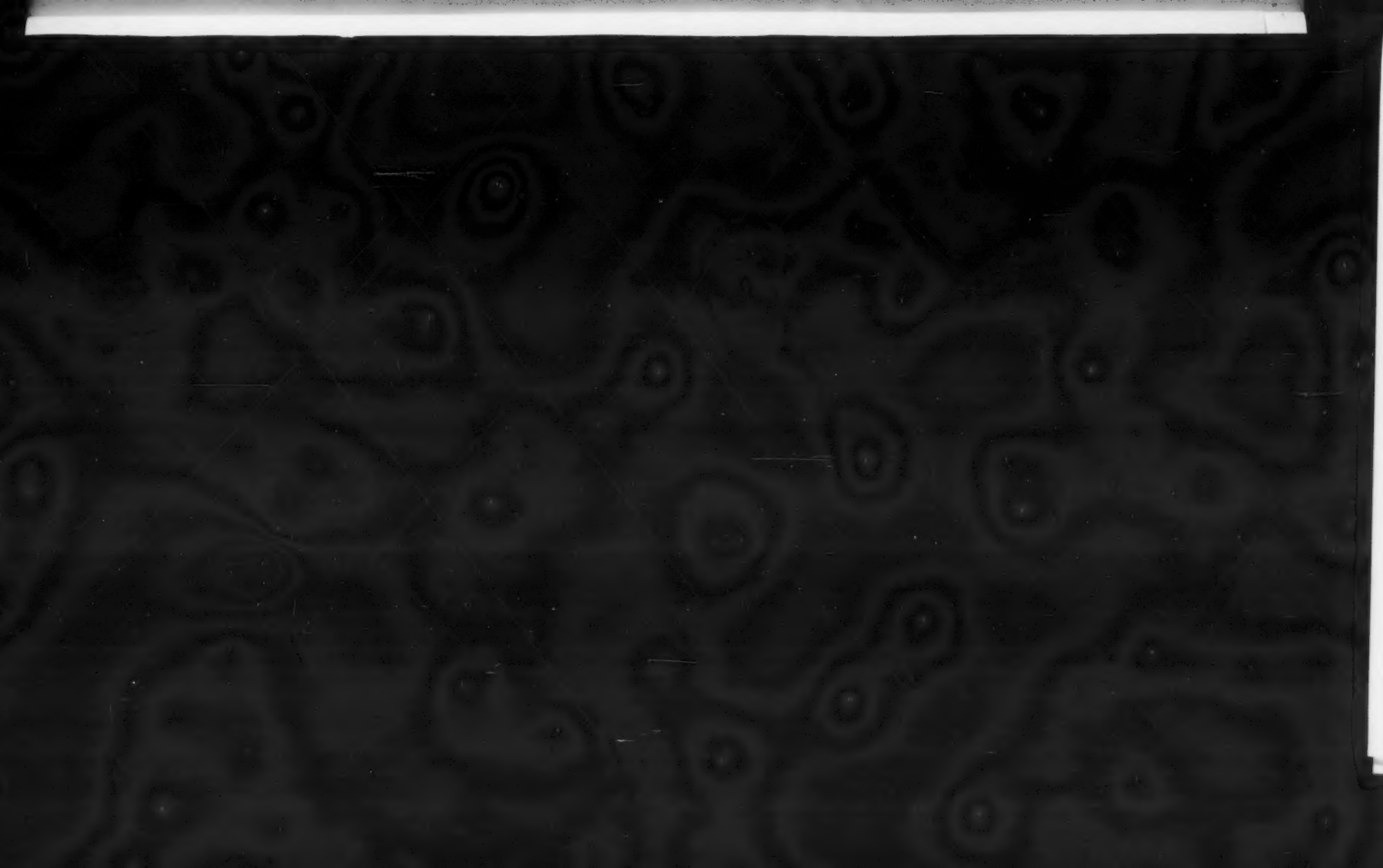
SPECIAL INTER-AGENCY STUDY
UNITED STATES AND CANADIAN STORAGE PROJECTS
COLUMBIA RIVER AND TRIBUTARIES
JANUARY 1955

LOCATION MAP

DAMS AND PROJECTS

PREPARED: O.J.	CHECKED: M.L.M.	PD-20-19/1
DRAWN: W.J.M.		

PLATE 1



increases, the effectiveness of each in downstream generation will decrease. This inevitable trend is explained briefly in the following paragraphs.

In the initial stage, and presumably through or somewhat beyond the C-level stage, hydro power can be developed more economically than alternative steam-electric power. Thus, through the C-level stage, all-hydro development is assumed. Under such development, storage has two purposes—control of mainstem floods in early summer and generation of maximum systemwide prime power. At times, the flood-control purpose permits somewhat less power to be generated than would be possible otherwise. The two purposes, however, are compatible when the storage is operated on a forecast basis. The purpose of maximum systemwide generation requires that potential output at the storage projects be limited, at times, in order that a maximum amount of water may be held in storage for future use by run-of-river plants downstream.

Under the present 7-month critical period (of storage release) a given volume of storage will materially increase downstream flows and, consequently, downstream generation. As storage projects are added the critical period will be extended, possibly as long as 44 months, with the result that the stored water will need be spread much thinner. Ultimately, still more storage would add little to usable generation downstream.

For flood control, upstream storage capacity has similar limitations. It is estimated that 24 million acre-feet of storage (moderately more than will be available in the C-level system) will effectively control high water equal to any past flood in the Columbia River system.

At or somewhat beyond the C-level stage, hydro projects then undeveloped probably will be at least as costly as alternative steam-electric developments. Thereafter, presumably, system expansion will be largely in steam-electric plants, because such plants can be operated as needed under the variable regional load.

Owing to the pressure of time, characteristics of this "D-level" (hydro-steam) system have not been studied in detail. In general, however, they will become somewhat as follows: (1) Available water will be used to generate maximum energy at all hydro plants, rather than maximum prime power; supplemental steam-electric energy will be generated as necessary to serve loads, especially those assigned ordinarily to run-of-river hydro plants. (2) The storage-release period will shorten drastically, reservoirs can be held at substantially higher average pool level, and generation at storage projects will be more than would be obtainable under an all-hydro system. (3) Flood control will become largely a byproduct of operation for power. (4) The overall operation of hydro plants, both storage and run-of-river, will be more efficient and economical than in the initial stage. In other words, at the D-level stage, storage projects in Canada will no longer afford a large advantage to the United States.

In evaluating Canadian storage, these considerations are immeasurably complicated by other factors. Included are the problems of (1) coordinating storage releases for generation, flood control, and other purposes; (2) determining nature and magnitude of advantages from Canadian storage as compared with those from United States alternatives and supplements; (3) determining whether power generated from release of storage should be assigned on the basis of total system cost or of "incremental" costs tacked on an existing system; (4) determining fair cash payments and/or divisions of power between Canada and the United States; (5) fairly appraising the declining capability of Canadian storage to generate power in the United States; (6) determining whether investments can be recaptured, and (7) devising workable methods of safeguarding national rights without jeopardizing the advantages that would accrue from integrating operation of the United States system with Canadian and transborder (Libby) projects.

Many of these problems can be resolved only by policy decisions. Policy being beyond its scope, this report considers only engineering aspects, and that only through the C-level stage. Comprehensive economic studies of the D-level stage, including appraisals of present and future reservoir projects, are necessary before all the technical aspects can be resolved in full. Such studies are being started by a subcommittee of the Columbia Basin Inter-Agency Committee. They are imperative because it is estimated that the D-level stage of development will be reached by about 1980, or at least 30 years before the end of the 50-year payout period that would apply to a Federal project started now.

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3. *Load growth.*—By conservative estimate, 45 million average kilowatts will be required to meet Pacific Northwest needs by 2005. The power produced by the several systems studies (or alternative systems of like magnitude) are estimated to be required to meet load growth in the following years:

Initial base system plus non-Federal resources (5,480,000 kilowatts)	[1] 1957
Initial base plus Arrow Lakes, Libby, and Mica Creek (7,860,000 kilowatts)	1964
C-level base system (10,500,000 kilowatts)	1970
C-level base plus Arrow Lakes, Libby, and Mica Creek (12,100,000 kilowatts)	1973
C-level base with 1,000,000 kilowatts steam (11,500,000 kilowatts)	1973
C-level base with 1,700,000 kilowatts steam, plus Arrow Lakes, Libby, and Mica Creek (13,800,000 kilowatts)	1976

[1] Interruptible load is included, thus advancing the date 2 years from the commonly accepted 1959.

4. *System gain.*—Table 2 shows the system gains in prime power if each storage project were added separately at various levels of development. Table 3 shows the corresponding gains if Mica Creek, Arrow Lakes, and Libby were added simultaneously. These two tables show, in a small way, how the prime power capability attributable to an individual project diminishes as the overall generating system expands.

TABLE 2.—*Summary of prime-power gains from individual projects (at market)*

Project		Projects added individually to—	
		Initial base (megawatts)	C-level base (megawatts)
Mica Creek	System total	1,780	1,110
	At site	704	680
	Downstream	1,076	430
	Steam		
Arrow Lakes	System total	265	150
	At site	0	0
	Downstream	265	150
Libby	System total	841	420
	At site	211	165
	Downstream	630	255
	Steam		
Penny Cliffs	System total	265	309
	At site	189	174
	Downstream	76	135
Bruces Eddy	System total	195	207
	At site	148	128
	Downstream	47	79
Boundary (Libby)	System total	121	84
	At site	45	39
	Downstream	76	45
Middle Snake	System total	1,330	1,295
	At site	1,197	1,155
	Downstream	133	140

TABLE 3.—*Summary of collective prime-power gains from Mica Creek, Arrow Lakes, and Libby projects*

Project	The three projects added simultaneously to—	
	Intial base (megawatts)	C-level base (megawatts)
Mica Creek:		
System total	1,417	1,028
At site	678	685
Downstream	739	343
Steam		
Arrow Lakes:		
System total	183	119
At site	0	0
Downstream	183	119
Libby:		
System total	613	383
At site	177	180
Downstream	436	203
Steam		
Three projects:		
System total	2,213	1,530
At site	855	865
Downstream	1,358	665
Steam		

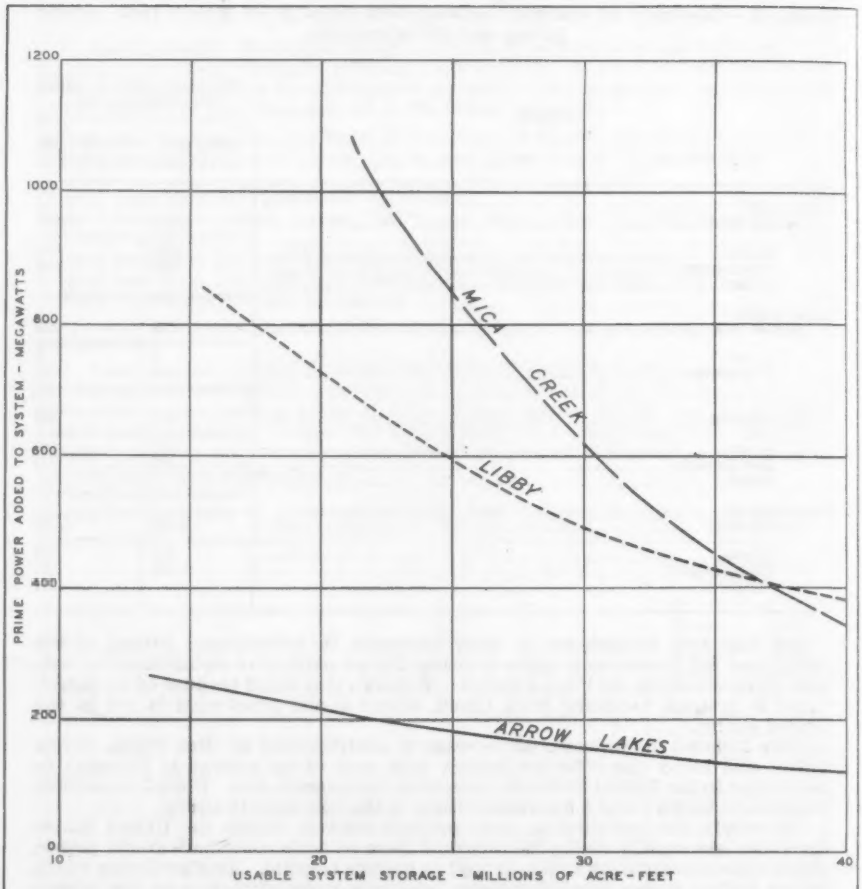
The indicated breakdown to show increases in system-total prime, at-site prime, and net downstream gains in prime has no particular significance for systems lying wholly in the United States. However, it is noted because of its significance in systems including Mica Creek, where at-site generation is not in the United States.

Plate 2 shows the pronounced decrease in contributions of Mica Creek, Arrow Lakes, and Libby (as a border project with part of its storage in Canada) to generation in the United States as the system increases in size. Plate 3 illustrates graphically tables 2 and 3 but relates them to the load growth curve.

Conversely, the contribution from projects entirely within the United States decreases less rapidly due to the fact that these projects contribute at-site power, which remains relatively stable, as well as storage benefits. Another factor which makes United States storage projects relatively more attractive as the system grows is that there is more undeveloped head below these reservoirs within the United States than is available in this country below the Canadian storage projects; for example, Bruces Eddy and Penny Cliffs initially make a contribution less than one-half that of Mica Creek to generation in the United States, but their contribution at C-level is greater than that of Mica Creek. There are two reasons for this change, the first being that from 60 to 70 percent of the generation creditable to Bruces Eddy and Penny Cliffs is at-site generation and the second is that the additional head (not utilized in the initial development) below Mica Creek at C-level amounts to only 245 feet while the additional head development below Bruces Eddy and Penny Cliffs is some 471 feet.

5. *Measure of power gain.*—As the principal advantage to the United States from upstream storage in the Columbia River Basin is the amount of power gain created in this country, it is important that the measure of that gain be reasonable and understandable.

The power gain attributable to each project was estimated as the increased system capability over a 20-year streamflow period such as 1929–48. A system operation study was made with the assumption that all projects in the base system were operating during this period. To determine the effect of adding the Mica Creek project, for instance, another system study was made with the assumption that the Mica Creek project was also in operation as an integral part of the system. In each case, the system was operated as closely as practicable to actual conditions if such river flows should recur in the future. The resulting increment to system prime power was attributed to the storage project. The same study also measures the increase in system energy.



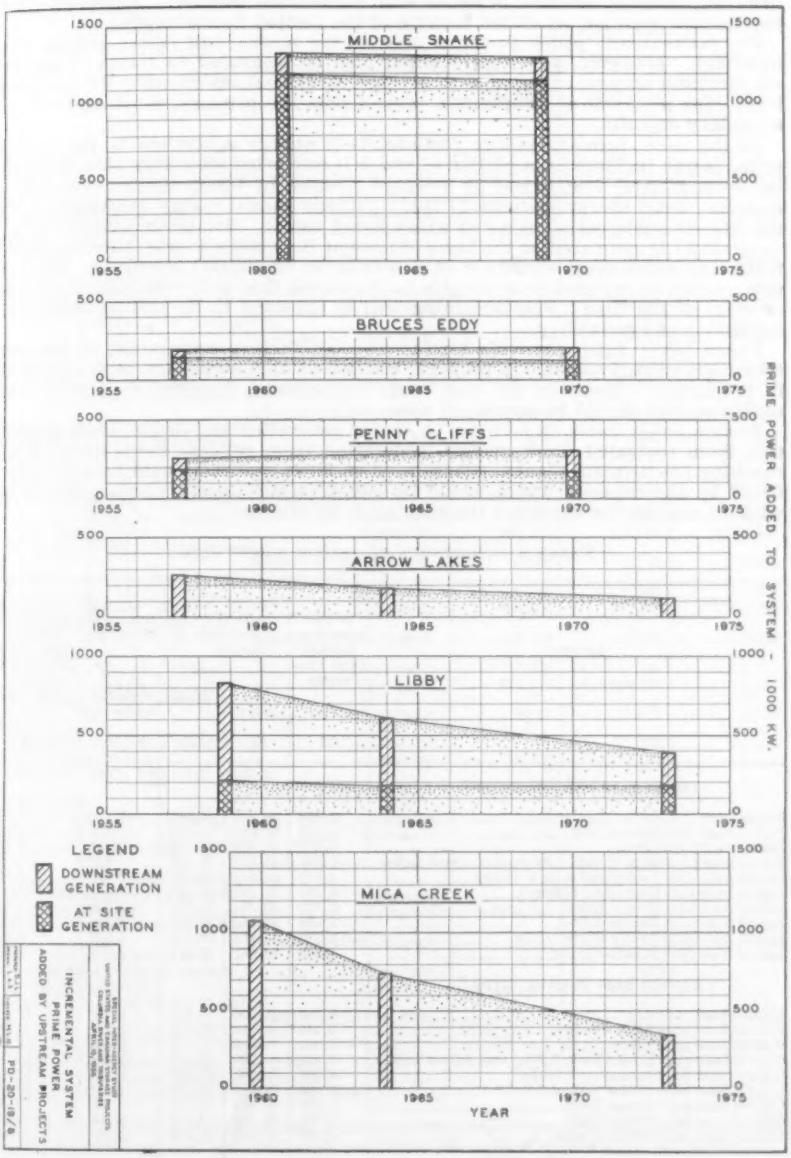
Note:
Curves indicate only general trend of prime-power production when each project is added separately to the system. Usable storage includes that of the project added.

SPECIAL INTER-AGENCY STUDY
UNITED STATES AND CANADIAN STORAGE PROJECTS
COLUMBIA RIVER AND TRIBUTARIES
APRIL 15, 1955

SYSTEM PRIME POWER
ADDED BY UPSTREAM PROJECTS

PD-20-19/7

PLATE 2


MIDDLE SNAKE
BRUCES EDDY
PENNY CLIFFS
ARROW LAKES
LIBBY
MICA CREEK
1500
1000
500
0
1955
1960
1965
1970
1975
PRIME POWER ADDED TO SYSTEM - 1000 KW.
YEAR
LEGEND
DOWNSTREAM GENERATION
AT SITE GENERATION
INCREMENTAL SYSTEM PRIME POWER ADDED BY UPSTREAM PROJECTS
PD-20-18/8
PLATE 3

The increase in prime power or in energy results from two factors: (1) the release of water from storage, which creates energy as it passes through the developed head downstream, (2) the natural flow that previously exceeded the installed capacity, but now is usable due to increased capacity. However, these two factors were not separated because of the limited time available.

For convenience, prime power is used as the measure of power gain in this summary. However, power gain might also be measured in terms of salable energy, total energy, energy due to storage, or dependable capacity for carrying load. For purposes of comparison, table 4 lists the primary, total, and salable secondary energies.

In the table, primary energy (column 3) is energy equivalent to the system prime power (column 2), a portion of which is converted secondary energy resulting from natural flow, firmed by released storage, by steam electric generation, or both. Total energy (column 4) is the average annual energy available during the 20-year study period, some of which is not usable. Salable secondary energy (column 5) is estimated on the basis of present Bonneville Power Administration rates and contractual structure at a maximum of 600,000 kilowatts. Half of this amount is expected to be salable to the extent that it is available 50 percent or more of the time. The remaining half is expected to be salable under any conditions of availability.

Prime power figures provide a relatively satisfactory comparison of the contributions of various storage projects, because salable secondary power is small in proportion. However, for long range evaluations, dependable capacity and usable energy should be appraised also.

System power gains, in addition to at-side generation and downstream generation from regulated flows, include generation from random unregulated flows reaching downstream plants. These random flows probably could be used effectively by the capacity which would be added to supplement steam generation, without necessarily requiring the regulation by storage.

TABLE 4.—*Summary of system power data*

System	Prime power at market 1,000 kilowatts	System average annual energy at market (millions of kilowatt-hours)			Required nameplate capacity including 7 percent reserve 1,000 kilowatts
		Primary	Total	Salable secondary	
(1)	(2)	(3)	(4)	(5)	(6)
INITIAL BASE SYSTEMS (HYDRO)					
Initial base	3,474	30,432	35,093	3,421	4,929
Initial base plus Mica Creek	5,254	46,025	50,075	2,275	7,874
Initial base plus Libby	4,315	37,799	42,192	2,835	6,525
Initial base plus Mica Creek, Libby, and Arrow Lakes	5,687	49,818	53,288	2,689	8,436
Initial base plus Libby and Arrow Lakes	4,520	39,595	43,570	2,639	6,763
Initial base plus Boundary (Libby)	3,594	31,483	36,025	3,471	5,210
Initial base plus Arrow Lakes	3,739	32,754	36,726	3,226	5,272
Initial base plus Bruces Eddy	3,669	32,140	36,596	3,324	5,249
Initial base plus Penny Cliffs	3,739	32,754	36,954	3,275	5,321
Initial base plus Middle Snake	4,804	42,083	45,198	2,379	6,968
C-LEVEL BASE SYSTEMS (HYDRO)					
C-level base	8,140	71,306	76,694	1,226	12,920
C-level base plus Mica Creek	9,250	81,030	88,686	2,068	14,960
C-level base plus Libby	8,560	74,986	81,061	1,552	13,626
C-level base plus Mica Creek, Libby and Arrow Lakes	9,670	84,709	92,499	2,076	15,713
C-level base plus Boundary (Libby)	8,220	72,007	77,427	1,124	12,828
C-level base plus Arrow Lakes	8,290	72,620	77,672	1,099	12,881
C-level base less Bruces Eddy	7,933	69,493	74,967	1,669	12,317
C-level base less Penny Cliffs	7,831	68,600	74,478	2,072	12,189
C-level base less Middle Snake	6,845	59,962	65,598	2,639	10,451
C-LEVEL BASE SYSTEMS (HYDRO AND STEAM)					
C-level base plus steam	9,010	78,928	81,246	684	13,590
C-level base plus Mica Creek and steam	10,670	93,469	96,035	660	17,129
C-level base plus Libby and steam	9,790	85,760	83,308	684	15,318
C-level base plus Mica Creek, Libby, Arrow Lakes and steam	11,090	97,148	99,848	660	17,448

TABLE 5.—*System cost summaries, annual incremental cost of power added to the system by storage projects based on average of total project costs allocated to power*

Project	Incremental to—		
	Initial base	C-level base	C-level base with 1,000 megawatts steam
(1)	(2)	(3)	(4)
Mica Creek (with power):			
Incremental prime at market—megawatts	1,780	1,110	1,660
Total annual cost—thousands	$51,130	$37,030	[1] $58,270
Cost per kilowatt prime at market—dollars per kilowatt-hour	28.72	33.36	[1] 35.10
Mica Creek (without power):			
Incremental prime at market—megawatts	1,076	430	980
Total annual cost—thousands	$35,550	$21,130	[1] $42,290
Cost per kilowatt prime at market—dollars per kilowatt-hour	33.04	49.14	[1] 43.15
Arrow Lakes:			
Incremental prime at market—megawatts	265	150	----
Total annual cost—thousands	$6,255	$1,500	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	23.60	10.00	----
Libby:			
Incremental prime at market—megawatts	841	420	780
Total annual cost—thousands	$29,185	$14,530	[2] $28,690
Cost per kilowatt prime at market—dollars per kilowatt-hour	34.70	34.60	[2] 36.78
Mica Creek (with power), Arrow Lakes and Libby:			
Incremental prime at market—megawatts	2,213	1,530	2,080
Total annual cost—thousands	$66,215	$55,535	[1] $76,775
Cost per kilowatt prime at market—dollars per kilowatt-hour	29.92	36.30	[1] 36.91
Mica Creek (without power), Arrow Lakes and Libby:			
Incremental prime at market—megawatts	1,535	850	1,400
Total annual cost—thousands	$50,805	$39,435	[1] $60,605
Cost per kilowatt prime at market—dollars per kilowatt-hour	33.10	46.39	[1] 43.29
Penny Cliffs:			
Incremental prime at market—megawatts	265	309	----
Total annual cost—thousands	$10,115	[3] −$15,140	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	38.17	49.00	----
Bruces Eddy:			
Incremental prime at market—megawatts	195	207	----
Total annual cost—thousands	$7,135	[3] −$10,120	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	36.59	48.89	----
Middle Snake:			
Incremental prime at market—megawatts	1,330	1,295	----
Total annual cost—thousands	$43,660	[3] −$50,060	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	32.83	38.66	----
C-level base plus 1,000 megawatt steam:			
Incremental prime at market—megawatts	4,664	----	----
Total annual cost—thousands	$163,735	----	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	35.11	----	----
C-level base less initial base:			
Incremental prime at market—megawatts	----	870	----
Total annual cost—thousands	----	$35,340	----
Cost per kilowatt prime at market—dollars per kilowatt-hour	----	40.62	----

[1] Includes 700 megawatts additional steam.
[2] Includes 450 megawatts additional steam.
[3] Project is a component part of the C-level base.

6. *Cost of added generation and transmission facilities.*—The estimated cost of adding generation and transmission facilities necessary to develop the indicated gain in generation at United States projects is shown in table 5.

Figures used in table 5 are in terms of average project costs, including a prorated share of (1) the costs of powerhouse, generators, and other powerhouse facilities, and (2) the cost of dams and reservoirs allocated to power. These are developed to show average annual cost and cost per kilowatt of prime power added to the system and delivered to load center. For purposes of comparison, all project costs have been computed on a basis of Federal financing and exclusive of

taxes, although it is not anticipated that all phase C projects will be federally constructed.

In this table, costs of the Mica Creek project include those of a reservoir without power facilities, resulting in considerably higher unit charges than for Mica Creek with power, where at-site and downstream generation share reservoir costs. In the case of Arrow Lakes at the C-level, no costs for downstream generation or transmission facilities are attributed to the project. This is because, under the assumed order of development, its storage complements the system at a time when no additional generating units are needed; this accounts for the low cost of power from Arrow Lakes in this particular circumstance.

As steam energy becomes a substantial component in the system, the maximum permissible payment for storage may be limited by the alternative cost of supplying the same amount of usable energy from steam-electric plants.

In computing the cost of additional generating capability, peaking requirements of each alternative system were determined, including 7-percent reserve. Costs then were determined on that basis, without regard to units currently installed or scheduled.

Transmission costs for hydro systems included in table 5 are based on Bonneville Power Administration's average estimated cost of $6 per kilowatt of peaking capability, plus a small integrating adjustment for the storage projects. Costs for stream generation include those for transmission.

7. *Hydrosteam study.*—In hydrosteam studies for the period beyond the C-level system, the following criteria were adopted:

(*a*) Virtually no change will be required in reservoir operations of the all-hydro period when steam is first added.

(*b*) Addition of steam plants was assumed at the stage when the C-level hydro system will have secondary power available 30 percent of the time. Function of the steam plants will be to firm the secondary hydro energy. When this stage is reached, it is assumed that steam power, supplemented by dump hydro energy, will cost about the some as alternative increments to C-level hydro.

(*c*) Hydro generating capacities would be increased as needed to operate with added steam energy.

8. *Flood control.*—Spring floods in the Columbia downstream from McNary Dam cause average annual damages of $31,100,000. About 90 percent, or $27,900,000, are considered to be preventable by feasible levees and regulation of flows through upstream storage projects.

As additional upstream storage becomes operable from the present to about 1970, flood-control benefits credited to levees diminish gradually. After 1970 the reservoirs are credited in the amount of (1) all damages in leveed areas that would be avoided by reducing the greatest flood of record (1894) to an in-channel flow of 800,000 cubic feet per second, and (2) damage outside of leveed areas by floods of more than 500,000 cubic feet per second.

Adequate flood-control storage eventually will be available in United States projects but, in the interim, storage at Mica Creek and Arrow Lakes could be used to reduce floods to the maximum extent practicable. Such use would diminish as new United States projects come into being.

It should be noted that there is no significant conflict between operation of storage in the Columbia River system for power and for flood control.

This summary considers two plans for use of the Canadian projects after 1975, the year by which practically all necessary storage would be available in the United States: (1) replace approximately 500,000 acre-feet of storage contemplated at Priest Rapids project; and (2) use remaining Canadian capacity to reduce flood flows further.

Under these two plans fair values creditable to flood control realized in the United States from the Canadian projects are as follows:

Average annual values

Project	Plan (1)	Plan (2)
Mica Creek	$650,000	$748,000
Arrow Lakes	105,000	222,000
Total	755,000	970,000

Benefit-cost ratios for flood control in similar projects to be built in the United States average 1.85 to 1, and this has been selected as a fair ratio for use in this study. Flood-control value of Canadian storage was divided between Mica Creek and Arrow Lakes projects, taking into account that none of the Arrow Lakes storage would be available for reduction of floods except when Mica Creek project reduces inflows to Arrows Lakes sufficiently to make some space available there.

SECTION III—SUMMARY

9. *The system.*—A relatively high level of hydro power development, both Federal and non-Federal, exists in the United States portion of the Columbia Basin. A part of this development is Bonneville Power Administration's extensive backbone transmission system. The highly integrated operation made possible by the Bonneville transmission system has permitted the Northwest power pool to make net gains in generation which could not have been realized otherwise.

Total United States Federal investment to achieve the initial base level of development will be about $2,500 million. It is this investment that is largely responsible for making Canadian storage currently advantageous to the United States. Without the prior investment, the advantage of Canadian storage would fall sharply because there would not be enough generation downstream to fully realize storage releases made in Canada.

Accordingly, no exaggerated concept of the long-range value of Canadian storage to the United States should be entertained. Canadian storage can be very desirable at the present time, but the initial value declines considerably in the long run, as indicated in this summary.

Conversely, development of alternative projects within the United States can be highly desirable in the long run because this Nation would retain the more stable at-site generation.

There is no great long-term engineering advantage to the United States in Canadian storage. The margin favoring Canadian storage is rather narrow.

Mr. JORDAN. This Special Interagency Study on United States and Canadian Storage Projects has served a very useful purpose. First, it has brought out, with unmistakable clarity, the regressive characteristics of storage values for power and the corollary fact that storage for power only must be evaluated not solely on a first added incremental basis, but rather in terms of average energy that may be dependable at least through the payout period of the project.

Secondly, it has emphasized the need for policy determinations with respect to the evaluation and proper recompense for downstream benefits from upstream storage.

And, finally, this report has pointed up the need for a more comprehensive and detailed official review by interested Government agencies of certain aspects of House Document 531, as outlined in a Senate Public Works Committee resolution adopted July 28, 1955, which reads as follows:

Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby, requested to review the report on the Columbia River and tributaries published as House Document No. 531, 81st Congress, 2d session, and other reports, with a view to determining the advisibility of modifying the existing project in any way at this time particularly with regard to present requirements of flood control including consideration of flood storage in Canada; the present needs of navigation; a restudy of hydroelectric power potentialities as part of a combined hydrothermal system; and consideration of all related water uses.

STATUS OF CURRENT REVIEW

Under the resolution quoted above, a comprehensive review of Columbia Basin plans is being carried out by the Corps of Engineers in

coordination with other Federal agencies, the States, and other interests involved. The study is scheduled for completion in the fall of 1957. At the present time, preliminary appraisals have been completed on a large number of potential storage projects in the United States. More detailed studies are being initiated on the more favorable prospects. Concurrently, studies are being carried out on the power market, the future role of thermal power and methods of evaluating the contributions of storage, hydro plants and thermal plants to the power system.

These review studies will give us valuable information on several points vital to further consideration of the international aspects of the problem. For example, we will get an up-to-date forecast of our power needs, both immediate and long range, and an analysis of the possibilities for meeting those needs with new hydro projects, expansion of existing projects, thermal plants, and storage developments. We will find out to what extent we can meet our needs with United States projects, and will establish the basis for evaluating the benefit to us of any Canadian storage which may be in prospect.

Mr. Chairman, we are looking forward with keen anticipation to the results of this interagency study.

ACTIVITIES OF KAISER ALUMINUM & CHEMICAL CORP. AND OF PAUL J. RAVER

The United States Section of the Commission is aware of certain negotiations and an agreement between the Kaiser Aluminum & Chemical Corp. and the Province of British Columbia regarding the desire of the corporation to create storage in Canada by building a dam across the Columbia River (lower Arrow Lake) near Castlegar, British Columbia, for the purpose of increasing the energy output of hydroelectric plants on the Columbia River in the United States, and of discussions which the corporation has had with the Bonneville Power Administration regarding the processing into energy of the storage releases and a division of the incremental energy thus generated.

Two months ago I received a letter from Kaiser Aluminum expressing its view that "there is no problem created coming within the jurisdiction of the International Joint Commission."

The following statements are quoted from my reply, dated January 23, 1956, prepared with the concurrence of my United States colleagues on the Commission:

> Your Arrow Lakes project is unique in several ways—first, because the project site is wholly within Canada and, second, because the beneficial effects of the project are wholly within the United States.
>
> With respect to the first, which involves your negotiations with British Columbia, we are convinced beyond any doubt that this Commission has no jurisdiction whatever. We cannot conceive the members of the United States Section becoming involved in the negotiations Kaiser has with Canadian goverments. With respect to the second point our lack of jurisdiction is equally clear. We cannot conceive the Canadian members becoming involved in negotiations Kaiser may have with Bonneville Power Administration or others whose projects may some day benefit from storage at Arrow Lakes.
>
> This is not to say, however, that the International Joint Commission has no interest in your project. We are tremendously interested in the whole subject of downstream benefits from headwater storage.
>
> Even though we conclude that this Commission has no jurisdiction in your project, we wish to take exception to your statement that "* * * the made stor-

age will be created solely from otherwise waste floodwaters * * *." This may be substantially correct if Arrow Lakes storage were brought into the present system with present hydraulic capacities at the several plants. We wish to point out, however, that 3 million acre-feet of floodwater would not be available every year above the ultimate hydraulic capacities of the existing plants. * * *

The United States Section also knows that Dr. Paul J. Raver of Seattle, Wash., conferred with Chairman McNaughton of the Canadian Section in Ottawa, perhaps a year or more ago, relative to the possibility of United States nationals, i. e., operating electric utilities in the State of Washington, building a dam at the Mica Creek site on the Columbia River in British Columbia. Both Chairman McNaughton and Dr. Raver informed the United States Section that such discussions had taken place in Ottawa. But the conference was not a matter with respect to which this Commission was officially concerned, although any such proposal is of interest to the members of the Commission.

SUMMARY OF SITUATION AS OF MARCH 1956

In brief, the situation with respect to Columbia River developments which have international aspects is as follows:

The United States has applied for International Joint Commmission approval of the Libby project which has been authorized by Congress. The Government of Canada, however, has stated officially that it will not be prepared either to consent to or oppose the Libby project until the Canadian studies of storage and diversion possibilities in Canada are completed.

United States Government agencies and other interests are desirous of making mutually acceptable arrangements for development of storage in Canada. Here again, the Government of Canada wishes to complete its studies of diversion plans before considering such arrangements.

Meanwhile, the United States interests have continued to develop the resources available on the United States side and are reviewing the needs and possibilities for development both on the United States side alone and on an international basis. We will complete all of our studies in 1957, probably in advance of the time when the Canadians will be ready to consider the international developments.

In addition, the United States Section stands ready at any time prior to the completion of our own review studies to discuss with Canada the possibilities for Libby Dam or any other storage project, provided such developments are not made subject to possible major diversions in Canada which would destroy or impair their usefulness to the United States.

Mr. Chairman, I conclude with that and the request that my statement as Chairman of the United States Section at the last official meeting of the International Joint Commission in Ottawa last October be included as a part of the record.

The CHAIRMAN. That may be included as a part of the record as you have requested. With reference to the statements attached to your remarks here, do you wish to have them filed with the committee or have reference made to them?

Mr. JORDAN. I think I have, sir, as I went along. I don't think I have overlooked anything. If I have, I hope that they will be included at the end of my statement.

(The statement referred to follows:)

SEMIANNUAL MEETING, INTERNATIONAL JOINT COMMISSION, UNITED STATES-CANADA, HELD OCTOBER 4–7, 1955

Upon the conclusion of its week-long executive session in Ottawa today, the International Joint Commission released a statement to the press.

Gov. Len Jordan and Gen. A. G. L. McNaughton are the Chairmen of the United States and Canadian sections of the Commission, respectively. The other members of the Commission are Messrs. R. B. McWhorter and Eugene W. Weber for the United States, and Messrs. George Spence and J. Lucien Dansereau for Canada.

In connection with the Columbia and Kootenay Rivers which rise in British Columbia and flow into the United States, Governor Jordan said that a Canadian plan to divert part of the flow of the Kootenay River into the Columbia, and thence into the Fraser River system along with part of the Columbia flow, for power-development purposes in Canada, would result in "very great injury" to the United States interests downstream in the Pacific Northwest States. (Full text of Governor's Jordan's statement on this topic is attached.)

General McNaughton emphasized his view that under the Canadian plan, there would be no injury to United States interests within the terms of the 1909 treaty.

The Commission will continue its studies of the Columbia to reach an understanding on the problems of mutual concern and benefit.

Engineers from both countries will meet later this month at Fredericton, New Brunswick, and Augusta, Maine, to organize the investigation of the St. Croix River Basin which the two Governments have requested the Commission to undertake. The investigation will include consideration of the uses of the river for various beneficial purposes, including the possible reestablishment of the St. Croix as a salmon-producing river.

Detailed studies are progressing satisfactorily on the effects of the power works now under construction in the International Rapids section of the St. Lawrence River, upon the water levels of Lake Ontario and upon downstream interests in the Canadian section of the St. Lawrence. The Commission recommended to the two Governments a short time ago the specific criteria which should be satisfied by any plan of operation of works which may be adopted.

Referring to the question of air pollution in the Windsor-Detroit area, the Commission expressed great satisfaction with the improved smoke emission performance of the majority of vessels operating in the Detroit River. The duration of objectionable smoke emission by vessels in that area has been reduced from 50.7 percent of the time in 1950 to 9.6 percent of the time this year.

A delegation headed by the Honorable Thomas M. Kavanagh, attorney general of Michigan, and including representatives of that State and of the city of Sault Ste. Marie, Mich., made representations to the Commission regarding the pollution of the waters of the St. Marys, St. Clair, and Detroit Rivers, which are the sources of water supply for many rapidly growing communities. The Commission's technical advisory board, consisting of representatives of both countries, are continuing their investigations in an effort to identify and insure abatement of pollution of these boundary waters.

The Commission held public hearings last month in Winnipeg, Manitoba, Minot, N. Dak., and Estevan, Saskatchewan, in connection with the apportionment of Souris River waters between the two countries. Several applications have been received by the Commission for authority to make increased use of the waters for domestic, municipal, sanitary, and other purposes. These applications are now being considered by the Commission, and it is expected that decisions will be reached in the very near future on these matters which are urgent for the people in the localities affected.

STATEMENT ON COLUMBIA RIVER REFERENCE, DOCKET 51, SUBMITTED BY CHAIRMAN LEN JORDAN, UNITED STATES SECTION, INTERNATIONAL JOINT COMMISSION, AT THE SEMIANNUAL MEETING IN OTTAWA, CANADA, OCTOBER 4, 1955

The Canadian section has very kindly caused to be supplied to the United States section of the Commission printed copies of the minutes of proceedings and evidence of the Standing Committee on External Affairs, House of Commons, containing the testimony of General McNaughton and other witnesses before that committee last spring. We have given very careful consideration to General

McNaughton's testimony, and find therein numerous statements with which we do not agree; and we desire that it be clearly understood that our decision not to deal specifically with such statements today shall not be construed as acceptance of or agreement with them.

At the semiannual meeting of the Commission in Washington in April 1955, General McNaughton outlined Canadian plans and views concerning development of the Columbia and adjacent basins and asked that his statement be regarded as an open document—available for use outside of International Joint Commission channels if required.

I should like now to present a statement for the United States section of this Commission in response to certain parts of General McNaughton's statement and to ask that it also be regarded as an open document.

Last April, Chairman McNaughton said:

"* * * I agreed—that I should give at the first appropriate opportunity an account of the plans being evolved by Canada for the utilization of the vast resources of water in the Canadian portion of the Columbia Basin and the adjacent watersheds.

"I am prepared to outline these plans before this Commission as a matter of information to indicate the progress which has been made, the magnificent possibilities which have been disclosed, and the expectations which we are coming to hold as to the immensely important beneficial economic consequences for Canada which will result.

"I say for Canada, by which I mean primarily British Columbia. But I do not overlook the possibilities which are becoming evident for cooperative arrangements between Canada and the United States for the exploitation and use of certain portions of these waters which we may find it advantageous to permit to continue to flow from Canada across the boundary.

"Accordingly, as part of my presentation, after I have given an outline of the general plans which are evolving for the use in Canada of the various heads and flows in and from the Columbia Basin, I will indicate those sections of the Columbia and the Kootenay where, I think, you may be interested in discussions for joint beneficial use of the particular waters in question.

"I will now, Mr. Chairman, give you a brief account of the plans which are evolving for the development of these Canadian resources in water in the Columbia Basin and the adjacent watersheds."

In outlining Canadian studies, General McNaughton divided the various ways that the Columbia could be developed into three principal cases, namely: Case 1, under which there would be no diversion of flows from the Kootenay River to the Columbia nor from the Columbia to adjacent basins; case 2, under which there would be diversion of from 5,000 to 8,000 cubic feet per second from the Kootenay to the Columbia; and case 3, under which there would be the case 2 Kootenay diversions plus diversion of up to 15 million acre-feet annually from the Columbia to the Fraser River Basin.

After discussing the three cases together with several variants, General McNaughton continued his remarks as follows:

"I have mentioned that we feel that in proposing these diversions we contravene no provision of the treaty of 1909, or necessarily impair any interest in the United States which has been legally acquired under that treaty.

"In our studies in the Canadian Section, International Joint Commission, of this aspect of the matter, it has become evident that under the conditions which would exist, the point of maximum use of the water from Canada in the United States would be at the Grand Coulee Dam.

"Here also the rights of the United States seem to us to be more explicit than anywhere else. And the reason for this is the International Joint Commission order of 1941, under authority of which the United States is permitted to flood up to the boundary with certain backwater effects running into Canada.

"Mr. Chairman, I now refer to table VII, which gives, so far as the information available to the Canadian Section, IJC, is concerned, our understanding of the present and prospective demand for water at Grand Coulee.

"Now, I use the term 'demand,' because we do not yet know how much of the flows mentioned would constitute lawful appropriations and priorities, interference with which might constitute an injury under the provisions of article II of the treaty of 1909, which would be recognized as such by the court of competent jurisdiction, which, in this case, is the exchequer court of Canada.

"And I would like to say, Mr. Chairman, that if you have any ideas on this subject, we would be glad to learn your views, which will be given very careful consideration, and we will consult the law officers of the Crown thereon."

With respect to this quotation, I should first like to say that we do not agree with the statement:

"* * * that under the conditions which would exist, the point of maximum use of the water from Canada in the United States would be at the Grand Coulee Dam."

I shall have more to say about this later. Nor do we agree with the statement:

"* * * necessarily impair any interest in the United States which has been legally acquired under that treaty."

With respect to the above-quoted remarks, certain basic axioms should be mentioned. They are:

1. Both United States and Canada recognize the doctrine of appropriation as being applicable in the area under consideration.

2. Under the doctrine of appropriation, the appropriator who is first in time is first in right.

3. A right is established when the actual appropriation is made.

With these basic points in mind, may we point out that the United States Government already has substantial investments in existing powerplants in the Columbia Basin amounting to about $1½ billion; in powerplants under construction, another billion dollars; plus another estimated $2 billion for powerplants expected to be built in the next 10 years. Wide publicity has been given all of these projects. Canadian and Provincial officials have been given all of our engineering reports. Never at any time has secrecy shrouded our building or our planning. All of these projects were planned and all of the funds are committed in anticipation that the waters of these international rivers would not be utilized by Canada in such a way as to jeopardize downstream interests.

Frankly, we are convinced that the diversion of 15 million acre-feet of water annually from the Columbia to another watershed wholly in Canada would result in very serious injury to downstream interests in the United States. Chief Joseph Dam, now nearly completed, will use 171,000 cubic feet per second. The Dalles, also under construction, will have an ultimate hydraulic capacity of 360,000 cubic feet per second. Other plants on the main stem also have sufficient capacities to utilize more water than would be available if 15 million acre-feet were diverted.

I submit for the record two tabulations showing estimates of unutilized water at projects on the main stem of the Columbia River based on flows which occurred during the 20-year period 1928–48. Data in the first table are predicated on a level of development of upstream storage projects in the United States with a total capacity of 21,384,000 acre-feet being available. The second table shows unutilized flows if only the existing Hungry Horse, Albeni Falls, and Grand Coulee storage projects were available.

The unutilized flows are the sum of all monthly flows in excess of the ultimate wheel capacity. The flows used in determining this excess are the regulated flows from the corresponding 20-year study for the interagency report of January 1955 on the United States and Canadian storage projects. The ultimate number of units are the same as shown in that report. Copies of this report have been supplied to the Canadian Section.

In examining these tables, I call your attention particularly to the two lines at the bottom of each table which indicate that there would be no surplus water in about half of the 20 years, and surplus of 15 million acre-feet would not be available except in a very few of the 20 years.

I think it proper to point out at this time that the injuries downstream occasioned by the annual diversion of 15 million acre-feet of Columbia water to another basin will be suffered by a sovereign—one of the high contracting parties—namely, the United States of America. Obviously, therefore, the United States, as an injured sovereign, will not be limited to the redress provided for an injured party (spelled with small letter "p") by article II.

After describing Canadian studies of possibilities for development of the Columbia River under cases 1, 2, and 3, General McNaughton suggested four subjects to be studied jointly under the Columbia Reference. Again I quote from the April record:

"To summarize, Mr. Chairman, the Canadian Section are prepared to discuss with you under the general terms of the Columbia Reference the corporative arrangements in relation to the undermentioned subjects which we might propose in our report to the Governments of the United States and Canada and to make appropriate advisory recommendations thereon as we may agree.

"One, for the temporary—the emphasis supplied, shall I say—use downstream in the United States of regulated flow from Mica storage;

"Two, and of Murphy Creek storage;

"Three, possibilities of Canada permitting an increase of level of approximately 42 feet at the point where the Columbia River crosses the boundary into the United States; thereby flooding upstream to the tail water of the Murphy Creek Dam. This would permit a corresponding increase in the height of the Grand Coulee Dam.

"Four, the possibility of Canada permitting an increase of level of approximately 37 feet at the point where the Kootenay crosses the boundary into the United States; that is, the eastern crossing; thereby flooding upstream to the tail waters of the Dorr Dam.

"This will permit a corresponding increase in the height of the proposed dam at Libby, Mont., above the water level at the boundary."

We object to the proposal of the Chairman of the Canadian Section for several reasons:

First, it is quite obvious that all four of the subjects proposed are intended to fit into diversion conditions that would prevail under Chairman McNaughton's case 3.

If the United States Section should agree to participate in the joint studies under conditions specified in the Canadian case 3 proposal, we would, by so doing, risk an assumption by others that we gave tacit approval to Chairman McNaughton's contention that a diversion of 15 million acre-feet annually can be made without injury downstream in the United States.

This we are not prepared to do.

As a matter of fact, we consider that such studies would not be within the terms of the Columbia River Reference. We submit, moreover, that no such diversions were contemplated by either of the high contracting parties when they sent the reference to the International Joint Commission on March 9, 1944. I quote from the reference:

"It is desired that the Commission shall determine whether in its judgment further development of the water resources of the river basin would be practicable and *in the public interest from the points of view of the two governments.*" [Italics added.]

We have already pointed out that the United States would suffer great injury under case 3 diversions. We must conclude, therefore, that the United States section has neither the authority nor the inclination to engage in joint studies based on acceptance of the theory of the case 3 diversions which are definitely against the public interest from the point of view of the United States.

In addition to the objections already stated, your attention is invited to the statements in the special report dated June 3, 1955, of the International Pacific Salmon Fisheries Commission which sets forth the destructive effect which diversions into the Fraser River might have on salmon fisheries there. The salmon industry has been revived as a result of joint United States-Canadian efforts and heavy expenditures. It is now worth over $15 million annually to the two countries with a potential value of over $26 million. We are seriously concerned with any proposals for the Fraser which would seem to threaten this valuable industry and be in conflict with our treaty "for the protection, preservation and extension of the sockeye salmon fisheries of the Fraser River system."

We particularly desire, however, that it be understood that our attitude is and consistently has been constructive with respect to investigations and formulation of plans by this Commission for further development within the Columbia River Basin of the water resources of that great basin in a manner practicable and in the public interest from the points of view of the Governments of both Canada and the United States of America under the reference of March 9, 1944. We suggest that the Commission now continue actively with the field investigations and joint studies, which have been underway for more than 11 years, with a view to:

(a) Consideration by the Commission and its International Columbia River Engineering Board of principles applicable, where appropriate, for analysis of water-resource developments wholly within either the United States or Canada, or in both, and of mutual concern and benefit to both countries;

(b) Accomplishment of necessary studies to develop facts and evolve a mutual understanding with respect to the engineering and economic aspects of possible water-resource developments of mutual benefits; and,

(c) Discussion and consideration of possible developments with a view to formulation of recommendations to the two Governments of a mutually beneficial and acceptable plan of development.

We of the United States section hope such studies may proceed immediately and go forward without interruption, and we are prepared to augment the existing International Columbia River Engineering Board, committee, and work groups as required to accomplish the work satisfactorily. Specifically we suggest enlarging the Columbia Board by one additional member from each country and leaving to the Board the problem of any changes in its committee and work groups.

Meanwhile, it seems appropriate that we inform our Canadian colleagues that the Corps of Engineers, in cooperation with other interested Federal agencies and State and local interests, has commenced a review of United States plans for development of the Columbia River Basin. It is expected that this review will develop many considerations pertinent to our joint studies under the Columbia reference. For example, it will develop specific data to take account of the changing and diminishing value of storage in the future as the cost of hydro possibilities increase and the ratio of hydro to thermal installations in the system changes. Instead of evaluating storage only on the basis of conditions at the beginning of its economic life, it will be possible to evaluate the storage over the range of changing conditions that can now be foreseen.

Also, it will be possible to take into account the amount of storage that can be advantageously utilized during various periods in the future and to apportion the beneficial effects of storage equitably among the interrelated projects which contribute to flow regulation, thus avoiding the inequities of assigning higher values to first added elements of a plan and remaining values to later elements.

SUMMARY

In summary, the United States Section of the Commission, constructively viewing the Commission's duties and responsibilities under the Columbia River reference, says:

(*a*) The diversions proposed by the Canadian Section would result in very great injury to the United States. For this reason alone, no satisfactory basis exists for joint consideration of the four subjects proposed by the Canadian Chairman last April for joint study. It may be observed, however, that any joint consideration of such diversions would carry the Commission outside of its proper sphere of action under the reference which definitely contemplates recommendations by the Commission for further development of the water resources of the Columbia Basin in a manner that "would be practicable and in the public interest from the points of view of the two Governments."

(*b*) The United States Section and the technical staffs of the various departments and agencies of the United States are ready, willing, and eager to collaborate with our Canadian colleagues in continuing the field investigations and studies thus far so admirably advanced under the terms of the reference which contemplates that any plan recommended by the Commission shall be of mutual significant, and permanent benefit to both Canada and the United States. This, we submit, is the duty and responsibility of the Commission as entrusted to it by the two Governments.

TABLE I.—*Unutilized flows at main-stem Columbia River projects (based on a level of development in the United States including about 21 million acre-feet of upstream storage)*

[Thousands of acre-feet above ultimate hydraulic capacity]

Year	Grand Coulee (26 units, 130,000 c. f. s.)	Chief Joseph (27 units, 171,000 c. f. s.)	McNary (20 units, 291,000 c. f. s.)	John Day (20 units, 287,000 c. f. s.)	The Dalles (22 units, 360,000 c. f. s.)	Bonneville (16 units, 210,000 c. f. s.)
1928 (start July)	0	0	0	0	0	0
1929	0	0	0	0	0	0
1930	0	0	0	0	0	0
1931	0	0	0	0	0	0
1932	6,495	1,900	100	2,915	0	8,025
1933	16,165	9,000	9,460	12,660	0	25,125
1934	13,105	8,200	1,875	6,150	0	24,525
1935	8,090	3,120	0	0	0	7,445
1936	4,180	1,130	0	715	0	7,475
1937	0	0	0	0	0	0
1938	6,795	800	1,130	2,740	0	14,385
1939	1,565	0	0	0	0	245
1940	0	0	0	0	0	800
1941	0	0	0	0	0	0
1942	3,990	1,415	0	0	0	5,440
1943	8,965	2,375	3,775	8,950	240	24,535
1944	0	0	0	0	0	0
1945	0	0	0	0	0	0
1946	12,325	4,675	2,055	5,510	0	17,450
1947	7,730	1,250	595	3,185	0	11,855
1948 (including June)	18,790	13,780	22,860	27,590	17,240	35,695
Number years of no surplus	9	10	13	12	18	8
Number years when 15,000,000 acre-feet of surplus water would not be available	18	20	19	19	19	15

October 1955.

TABLE II.—*Unutilized flows at main-stem Columbia River projects (based on existing storage projects)*

[Thousands of acre-feet above ultimate hydraulic capacity]

Year	Grand Coulee (26 units, 130,000 cubic feet per second)	Chief Joseph (27 units, 171,000 cubic feet per second)	McNary (20 units, 291,000 cubic feet per second)	The Dalles (22 units, 360,000 cubic feet per second)	Bonneville (16 units, 215,000 cubic feet per second)
1928 (including July)	6,327	3,815	0	0	4,920
1929	3,765	715	0	0	5,060
1930	4,070	185	0	0	775
1931	1,500	0	0	0	0
1932	18,020	10,555	11,760	4,755	28,575
1933	22,205	14,065	16,525	9,195	33,550
1934	18,855	9,985	5,550	0	21,430
1935	14,315	8,690	4,225	475	16,715
1936	9,360	3,305	3,840	0	15,700
1937	4,475	0	0	0	4,485
1938	16,240	8,780	10,300	4,460	27,070
1939	7,645	240	0	0	6,885
1940	4,065	890	0	0	5,310
1941	0	0	0	0	899
1942	10,615	5,660	3,570	0	14,460
1943	15,130	7,750	14,315	3,630	36,510
1944	0	0	0	0	655
1945	6,970	2,140	2,975	0	12,695
1946	20,960	13,490	13,965	6,645	31,605
1947	16,540	9,005	11,580	3,840	24,570
1948 (including June)	23,750	18,795	32,670	26,255	44,770
Number years of no surplus	2	4	9	13	1
Number years when 15,000,000 acre-feet of surplus water would not be available	12	19	18	19	10

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The CHAIRMAN. Does that conclude your statement?

Mr. JORDAN. Yes, sir.

The CHAIRMAN. Thank you very much. Your statement is a very comprehensive document, it seems to me, which will require a great deal of study in order to master the problems involved.

The next witness will be Mr. Outerbridge Horsey, director of the Office of British Commonwealth and Northern European Affairs.

STATEMENT OF OUTERBRIDGE HORSEY, DIRECTOR OF THE OFFICE OF BRITISH COMMONWEALTH AND NORTHERN EUROPE AFFAIRS, DEPARTMENT OF STATE

Mr. HORSEY. Mr. Chairman, I am Outerbridge Horsey, director of the Office of British Commonwealth and Northern European Affairs in the Department of State.

The CHAIRMAN. Do you have a prepared statement?

Mr. HORSEY. I have a prepared statement.

The CHAIRMAN. Do you wish to file the statement or do you wish to give us a brief of it and let the full statement be placed in the record?

Senator MORSE. It is a brief statement. I suggest that the witness be allowed to present it.

Mr. HORSEY. I shall be glad to read the statement, Mr. Chairman. It is relatively brief.

The CHAIRMAN. Very well.

Mr. HORSEY. Governor Jordan has described the work of the International Joint Commission in great detail. As you have heard him explain, it handles boundary waters problems which are essentially technical and which have been referred to it by the Governments of Canada and the United States, or by private entities. The Department of State acts for our Government in initiating formal references to the IJC after obtaining and coordinating the views of the interested Federal agencies. Thereafter the problem is worked on by the IJC until it submits a conclusive report to the two Governments. In the course of its deliberations it receives from the State Department any necessary policy guidance in connection with our relations with Canada or advice on the interpretation of applicable treaties.

The IJC has undertaken more than 70 assignments of varying importance since its organization in 1912, and it has settled practically all of these in a manner acceptable to the two Governments. Among the more important tasks have been those at Niagara and the St. Lawrence. Our treaty of 1950 with Canada divided the waters at Niagara for power development and provided that the IJC should recommend the design of remedial works to preserve the scenic beauty of Niagara Falls and supervise the construction of the works. This is being done to the satisfaction of all. In the St. Lawrence, which is one of the most complicated jobs which it has tackled, the IJC after exhaustive study worked out the order of approval governing the development of the very vital St. Lawrence seaway and power projects.

As for the power potential of the Columbia River Basin, from the point of view of the Department of State this problem has two aspects. It is an internal United States problem as far as the determination of hydroelectric needs in the Northwestern United States

is concerned, and the responsibility for initiating programs to develop the basin lies with those agencies of the Government which are responsible for the Federal Government's power policies. Thereafter, and only on the request of one or more of these agencies, the State Department acts as coordinator and agent in seeking any necessary agreement with Canada.

To illustrate our role, I will summarize the history of State Department participation in the Libby Dam matter. On March 9, 1944, following negotiations undertaken by the State Department at the request of the War and Interior Departments, as Governor Jordan has mentioned, the Governments of Canada and the United States, acting under article IX of the Boundary Waters Treaty of 1909, asked the IJC to study the development of the water resources of the Columbia "which would be practicable and in the public interest from the points of view of the two Governments." The IJC, in turn, established the International Columbia River Engineering Board, to survey the possibilities. As the studies progressed, an interim report of the Engineering Board revealed certain potentialities in the basin. On January 12, 1951, the Secretary of State, acting under article IV of the Boundary Waters Treaty, sent an application to the IJC requesting its approval for a Libby Dam project on the Kootenai River in Montana. IJC approval was necessary because the proposed reservoir would have flooded across the international boundary into Canada. However, difficulties arose because of the extensive relocation of roads, railroads, and other United States facilities, and because the Canadian members of the IJC insisted that British Columbia, in return for land which would be flooded by the proposed project, should be repaid by a share of the power produced rather than by a money payment. The United States had indicated its willingness to pay some $7 million for lands that would be flooded and for the relocation of railroads and highways. In due course, the Secretary of the Army requested the Secretary of State to withdraw the project from the consideration of the IJC and this was done on April 8, 1953.

On May 22, 1954, the Secretary of State, at the request of the Secretary of the Army, sent another application to the IJC for a revised Libby Dam project. The dam was now to be placed farther upstream and the new plan avoided some of the difficulties with local facilities which had characterized the earlier proposal. A statement in response to our proposal was forwarded to the IJC from the Canadian Department of External Affairs on July 7, 1954. It stated that the Government of Canada was not prepared either to consent or to oppose, but made clear the Canadian view that any Libby Dam arrangement should provide for Canadian interests to be recompensed with—

> an amount of power based on the increase of level permitted at the international boundary and a share in downstream benefits of storage in power on a basis to be negotiated.

On behalf of the interested United States Government agencies, on September 28, 1954, the Department of State sent to the IJC the United States Government's statement in reply to the Canadian Government's response. This said—

> the Government of the United States is prepared to consider equitable recompense to Canada through the sale of power, or otherwise, for the value which

the Canadian natural resources would have for the production of power, taking into account the extent to which the project will result in compensatory benefits in Canada.

However, Canada apparently was not interested in concluding a negotiation over the Libby Dam matter, even with the possibility of payments of power and a share in the downstream benefits. On December 20, 1954, the Canadian Minister of Northern Affairs and National Resources announced that Canada would undertake an investigation—

to determine whether it would be economically feasible to divert water from the upper Columbia River into the Fraser River system in British Columbia.

This water could then be stored and used at power sites in the Fraser River, thereby keeping the water and power entirely in Canada. The Canadian Government is making this study in order to complete its engineering data, maps, and economic studies of the Canadian portion of the Columbia, which seems to be a reasonable desire on its part. This further Canadian study is still in progress. In the meantime, our Libby Dam proposal rests with the IJC until the additional Canadian studies are completed.

Once all studies are completed, the Canadian and United States sections of the IJC will have assembled the full engineering data on which to work out a report and recommendations to the two Governments.

Senator MORSE. Mr. Chairman, in behalf of my colleagues on the Foreign Relations Committee I agreed to ask Mr. Horsey a couple of questions in regard to the relationship between the IJC and the State Department, for purposes of information.

It may be, Mr. Horsey, you are not the witness to answer these questions. It may be we should get the information directly from the Secretary of State or someone else in the Department.

We would like the record to show, if you are prepared to give it to us, the administrative relationship between the IJC and the State Department. I thought when you started out in the first paragraph you might give us the material which we seek, but it is not adequate. What administrative control, if any, does the State Department have over the IJC, or would it be proper to say that the IJC is an independent executive agency as far as the State Department is concerned?

Mr. HORSEY. Mr. Chairman, I think it would be correct to say that, as far as its substantive work is concerned, the United States Section of the IJC is an independent agency. However, the Department of State has an administrative connection with its activities because we budget under the State Department request for appropriations each year the amount of money needed to fund the activities of the United States Section.

Senator MORSE. Eliminate the IJC from this hypothetical question which I wish to put to you. Call it X. I do not care whether it is IJC in connection with Canada or ABC in connection with Mexico or MNO in connection with any other thing. I just want to talk about this type of commission which carries on negotiations with a foreign power. Is it not true that such negotiations inevitably lead into at least overlapping activities with Foreign Service officers?

Mr. HORSEY. Mr. Chairman, I would not say that it was inevitable that the activities would overlap. I think it is possible that they

would. I should add, Mr. Chairman, in further elaboration of the first question, that the Department of State, acting on behalf of the interested Federal agencies directly concerned with water resources in the United States, has this additional relationship and control, if you wish, over the work of the United States Section of the IJC. The Department of State is the channel for forming the precise terms in which problems are referred to the International Joint Commission. The Department of State acts as the agent for the transmission of the United States Government's request for action on a particular project to the IJC.

Senator MORSE. Would you expand that a little bit so I can see how that works?

Mr. HORSEY. Perhaps with reference to the Libby Dam project, expanding what I said earlier, I could illustrate that function. After the initial application had been filed at the request of the Secretary of the Army, the rules of procedure of the IJC provide that either Government in turn may make statements on the application. When it came the turn of the United States Government to do it, my office took the initiative in convoking representatives of the Department of the Interior, the Corps of Engineers, and the Federal Power Commission to consider what further steps on the Libby Dam application the United States should take.

Senator MORSE. Is it true, then, that the Foreign Service Division of the State Department operates under your jurisdiction and direction?

Mr. HORSEY. Yes.

Senator MORSE. Let's go back to my hypothetical, again forgetting about IJC. What about such an independent executive agency in the field of foreign policy? Suppose such an agency operating on Mexican problems found it desirable to enter into some negotiations, shall we say, in regard to the desirability of reestablishing the operation of American oil interests in Mexico, which I happen to think would be highly desirable, but that is immaterial. Would the Mexican desk in our Foreign Service be very much interested in the operation of such a quasi-independent agency?

Mr. HORSEY. That is to say, would they coordinate their work with the activities of an agency dealing with Canada?

Senator MORSE. In this hypothetical, Mexico.

Mr. HORSEY. I think it is fair to say they would, in the same way.

Senator MORSE. Is there a potential danger that the operation of such an independent or quasi-independent executive agency working in the field of foreign policy may conflict with the policies of the Foreign Service desks of the countries with which the negotiations take place?

Mr. HORSEY. Mr. Chairman, I would say that in theory there is a potential danger. I should add that I know of no occasion in our particular work on which there has been such a conflict.

Senator MORSE. What is your explanation as to why you think you have been able to avoid it?

Mr. HORSEY. Close relationships, I should say, between the United States Section in the case of the IJC, and the Department of State; the geographic area and the legal adviser's office, too.

Senator MORSE. How many agencies of the nature of the IJC do we have at the present time?

Mr. HORSEY. We have a similar Commission dealing with similar problems with Mexico. That is the only one that occurs to me, Mr. Chairman.

Senator MORSE. Is there none with Panama?

Mr. HORSEY. There is none of this nature with Panama, so far as I know.

Senator MORSE. How are the members of these executive agencies appointed?

Mr. HORSEY. They are appointed, Mr. Chairman, by the President.

Senator MORSE. Are they confirmed by the Senate?

Mr. HORSEY. They are not confirmed by the Senate.

Senator MORSE. Are the officers of the Foreign Service confirmed by the Senate?

Mr. HORSEY. Yes, Mr. Chairman; they are.

Senator MORSE. Do you know of any reason or policy as to why there should be a difference in the two types of appointment, one requiring confirmation and the other not?

Mr. HORSEY. Sir, I do not know the origin of that distinction.

Senator MORSE. Would you say that these independent executive foreign policy agents exercise a considerable amount of influence and decision determination with respect to American foreign policy over the relationships with the countries with respect to which they have jurisdiction?

Mr. HORSEY. I would be inclined to substitute the word "limited" for "considerable" in estimating the influence. It is a question of degree, Mr. Chairman. By and large, I would agree with the statement.

Senator MORSE. Let us substitute an even more innocuous word, "some."

Mr. HORSEY. Certainly, yes, sir; unquestionably.

Senator MORSE. Please correct my interpretation if I am wrong. Your testimony on the questions I have put to you would justify my inferring from what you have said that there is complete harmony and cooperative relationship between these agencies and the Foreign Service desks, because you have in each instance been able to work out with these executive agencies a program of cooperation mutually satisfactory to the officials of each group.

Mr. HORSEY. Yes, sir; that is a fair inference.

The CHAIRMAN. The International Joint Commission was originally set up in 1909; is that true?

Mr. HORSEY. Yes, Mr. Chairman.

The CHAIRMAN. Prior to that they had no such commission to determine boundary questions.

Mr. HORSEY. No, Mr. Chairman, there was no commission with the powers of the present International Joint Commission. There was an International Waterways Commission, as Governor Jordan mentioned.

The CHAIRMAN. The problems developing as a result of these waterway questions have made it necessary to establish the Commission; that is principally the cause of setting up the Commission.

Mr. HORSEY. Yes.

The CHAIRMAN. Thank you for your statement.

Senator NEUBERGER. May I ask one question of Mr. Horsey, Mr. Chairman?

The CHAIRMAN. Yes.

Senator NEUBERGER. There is one thing I am trying to recall. My memory may be very faulty and, if so, I hope you will forgive me. A good portion of your very interesting testimony was devoted to a discussion of the history of the Libby Dam negotiation. I seem to recall—again I repeat my memory may be faulty—that in either 1953 or 1954 legislation was introduced to deauthorize Libby Dam. Am I wrong about that? It is a tenuous recollection.

Mr. HORSEY. Mr. Chairman, I don't know.

The CHAIRMAN. Did you answer the question?

Mr. HORSEY. Yes, Mr. Chairman. I do not have that information.

Senator NEUBERGER. The reason I ask the question is that it seems to me, Mr. Chairman, if such legislation were introduced, that is a very significant part of the Libby history. I am going completely by memory, and the facts may refute me entirely. A few minutes ago I asked General Itschner of the Army engineers if he recalled anything on this. He did not. He said he had been trying to check with his office, but of course they do not have all their records available at their fingertips.

I seem to remember that legislation was introduced to deauthorize Libby at the request of the administration, by leading members of the Public Works Committees in both Chambers. If that did occur, is that not a very significant part of the whole Libby Dam negotiation and the history of the collapse of the negotiation?

Mr. HORSEY. Mr. Chairman, I think it certainly would be significant in the history of the negotiations, and it occurs to me that the reference to the congressional intent to withdraw the previously granted authorization for the construction of the dam may be related to the action taken by the Secretary of State, as I indicated. This was administrative action at the request of the Secretary of the Army to withdraw the previously submitted application from the International Joint Commission.

Senator NEUBERGER. It would be a much further step if legislation were introduced utterly to deauthorize it.

Mr. HORSEY. Yes, sir.

Senator NEUBERGER. I do not know whether the distinguished chairman, the senior Senator from Montana, recalls anything on that or not. I am going completely by my memory. I did not know so much of your testimony would be devoted to the Libby project, Mr. Horsey.

Mr. Chairman, I just wonder if I could not make the request that if such legislation were introduced, copies of those bills along with any pertinent correspondence which was made public about it be included as a part of this record, because Libby Dam, in which I know you are personally so interested, was discussed at length by Mr. Horsey.

The CHAIRMAN. Yes.

Mr. HORSEY. Certainly we shall inquire, Mr. Chairman, and offer to the committee any such correspondence.

The CHAIRMAN. Thank you.

(Mr. Horsey subsequently sent word that a search had disclosed no correspondence of this character in the files of the Department of State.)

Senator DWORSHAK. Does the Senator from Oregon know whether those bills were reported either by the House Committee on Public Works or the Senate Committee on Public Works?

Senator NEUBERGER. I do not know. The reason I think it is fairly significant—again I am going to have to be forgiven if my memory is not correct—is that they were introduced by Members of the Congress who were in key positions on those committees but were not from the region involved, indicating that it was probably by request. Again please forgive me if my memory is not accurate.

The CHAIRMAN. There was another controversy before the International Joint Commission involving the Waterton and Belly Rivers, but I understand they are not in the Columbia Basin. Is that true?

Mr. HORSEY. I am not familiar with that project, Mr. Chairman.

The CHAIRMAN. I believe that is the situation there. For that reason they would not come before this hearing.

I would like to say at this time that the committee would like to have Mr. Len Jordan appear before it again at the conclusion of the hearings so we may ask him such further questions as may be necessary to aid us in the consideration of these matters.

Senator NEUBERGER. Mr. Chairman, I have just been handed a memorandum by Gen. Emerson C. Itschner, the Assistant Chief of the Army Engineers, on whom we all rely a great deal for information, and I will read the memorandum for the record because I think it is very important to any discussion of Libby Dam.

Deauthorization bill, Libby Dam, 83d Congress, 1st session; April 22, 1953, Senator Martin, S. 1719, to deauthorize; also H. R. 5377, Dondero.

Further the memorandum states—

84th Congress, 1st session, January 5, 1955, H. R. 419, Dondero.

If I am not mistaken, are not both Senator Martin and Mr. Dondero the respective ranking Republican members of the Senate Committee on Public Works and the House Committee on Public Works?

I should think, Mr. Chairman, if we are to have any discussion of the Libby project, which is at the heart of this whole Upper Columbia River development, as you so well know, we should find out the history of the reasons for those bills. It seems to me, just giving a "horseback" opinion, that the distinguished and very able Members of Congress who introduced them, coming as they do several thousand miles from the area, must have done so by administration request, because they were at one time ranking majority members and now ranking minority members of those committees. I do think this ought to be part of the record to find out about it.

The CHAIRMAN. It may be made a part of the record as requested.

(The following letter of explanation was subsequently received from Senator Edward Martin for inclusion in the record at this point:)

UNITED STATES SENATE,
April 10, 1956.

Hon. JAMES E. MURRAY,
Chairman, Interior and Insular Affairs Committee,
United States Senate,
Washington, D. C.

DEAR JIM: My attention has been called to an incident which occurred during the hearings on the Columbia River Basin, before your committee, on March 22, 1956.

I refer to a colloquy between Senator Neuberger and Mr. Outerbridge Horsey, which appears on pages 61–64 of the transcript of that day. Senator Neuberger referred to legislation which he recalled had been introduced "at the request of the administration," to deauthorize the Libby Dam. Subsequently, General Itschner submitted a memorandum which identified this legislation as a bill I had introduced in the 83d Congress.

I wish to answer the question very clearly, and have made a part of the record the fact that S. 1719, to deauthorize the Libby Dam, was not introduced at the request of the administration, and had nothing to do with any policy expressed by the present administration.

S. 1719 was introduced by me on April 22, 1953, at the request of the late Senator Hugh Butler of Nebraska. I was then chairman of the Senate Public Works Committee, and he was chairman of your committee. His interest in the matter arose out of complaints he had received from the Great Northern Railroad, which claimed it would suffer greatly because of the plans then under consideration for the location of the project. I was told, also, that the cost of the Libby Dam would far exceed the engineers' estimates due to these relocation problems. It is my understanding that some of these objections have subsequently been removed by revisions in the engineers' plans.

No action was ever taken on S. 1719 by the Senate Public Works Committee, and upon receipt of adverse reports from Interior and the Corps of Engineers, the matter was dropped.

Very sincerely,

EDWARD MARTIN.

The CHAIRMAN. Does that conclude your testimony, Mr. Horsey?

Mr. HORSEY. Yes, Mr. Chairman.

The CHAIRMAN. Thank you very much.

There are no other witnesses scheduled for today. We will adjourn now until 10 o'clock Monday, March 26, when witnesses from the executive agencies will appear to testify—the Corps of Engineers, Federal Power Commission, and Department of the Interior.

(Whereupon, at 3:35 p. m., the committee adjourned until 10 a. m., Monday, March 26, 1956.)

UPPER COLUMBIA RIVER DEVELOPMENT

MONDAY, MARCH 26, 1956

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The committee met, pursuant to recess, at 10:15 a. m. in room 224, Senate Office Building, Senator Richard L. Neuberger, Oregon, presiding.

Present: Senators W. Kerr Scott, North Carolina; Richard L. Neuberger, Oregon (presiding); and Henry C. Dworshak, Idaho.

Also present representing the Committee on Foreign Relations: Senators Wayne Morse, Oregon; and George D. Aiken, Vermont.

Senator NEUBERGER. We will come to order.

I understand that the chairman of the committee, Senator Murray, will not be able to be here, so in his place I will be acting chairman. We have been informed that other members of the committee will be here later in the morning, but I think we should get underway at this time.

As some of you know, these hearings on the policies to be followed in using the resources of the upper Columbia River Basin began the end of last week, at which time we heard from ex-Governor Jordan, representing the International Joint Commission, and from Mr. Horsey, representing the State Department. We will start today with a witness whom we often rely upon for information from the Corps of Engineers, who of course are vitally concerned in the development and use of resources of the upper Columbia River Basin, Maj. Gen. Emerson C. Itschner, the Assistant Chief of Engineers for Civil Works.

General Itschner, we are very happy to have you with us. I hope you will forgive me for being a little late this morning. I didn't realize I would be called upon to sit at the head of the table, as I am.

STATEMENT OF MAJ. GEN. EMERSON C. ITSCHNER, ASSISTANT CHIEF OF ENGINEERS FOR CIVIL WORKS; ACCOMPANIED BY MAJ. FELIX R. GARRETT, ASSISTANT CHIEF OF CIVIL WORKS FOR POWER; CHARLES W. KINNEY, CHIEF, POLICY BRANCH, PLANNING DIVISION, CIVIL WORKS; AND GORDON H. FERNALD, CHIEF OF PLANNING BRANCH, NORTH PACIFIC DIVISION, PORTLAND, OREG.

General ITSCHNER. I am sure we will have adequate time, sir.

Mr. Chairman, I appreciate being afforded this opportunity to testify on the subject of Columbia River water resources. I regret greatly that the Chief of Engineers, General Sturgis, is unable to be

present because of a prolonged absence. However, I can assure you that he is most interested in the proper and complete development of the Columbia Basin, and the views expressed in my statement this morning have his full concurrence.

First, I would like to introduce members of the Corps of Engineers who are present today to answer any detailed questions which you may have. They are:

Maj. Felix R. Garrett, Assistant Chief of Civil Works for Power; Mr. Charles W. Kinney, Chief, Policy Branch, Planning Division, Civil Works; and Mr. Gordon H. Fernald, Chief of the Planning Branch, North Pacific Division, in Portland, Oreg., who has come here for this specific purpose.

The Corps of Engineers has actively participated in the planning and development of the water resources of the Columbia River Basin in carrying out its regularly assigned responsibilities for navigation, flood control and related multiple-purpose uses. For this reason it is one of the agencies that has been called upon to advise and assist the International Joint Commission on those aspects of water resources development which are of mutual concern and interest to Canada and the United States.

The first comprehensive report on the water resources of the Columbia River was completed by the Corps of Engineers in 1932. This report, known as the original Columbia 308 report, was published as House Document 103, 73d Congress, 1st session, and was the basis for much of the early development on the Columbia River. In 1943 the Congress requested the Chief of Engineers to review this report with a view to developing an up-to-date comprehensive plan of development. This review was completed in 1948 and was published as House Document 531, 81st Congress, 2d session, dated March 20, 1950.

During the initial phases of the 1948 review study it was recognized that the interrelation of possible developments in Canada and the United States should be considered. Accordingly, it was arranged through diplomatic channels to have the international aspects of the Columbia studied by the International Joint Commission as provided for in article IX of the Boundary Waters Treaty of 1909. Priority in the international studies was given to those matters which would directly affect any recommendations the corps might make to Congress for authorization of a comprehensive plan. The Libby project on the Kootenai River in Montana was the only feature of the recommended plan which depended on international arrangements.

The corps plans for this project were studied by the International Columbia River Engineering Board, an agency of the International Joint Commission, and favorably reported upon at hearings on July 27, 1948, in Bonners Ferry, Idaho. With this assurance, the Libby project was included in the main control plan and it was recommended for authorization in House Document 531.

It was recognized, of course, that plans for storage in Canada might ultimately be developed, but such plans would not adversely affect—on the contrary, they probably would benefit and supplement—the main control plan being developed at that time. Further, there were no specific plans for development in Canada, nor was there any indication that Canada might consider diversion from one basin to another within Canada.

After authorization of Libby Dam, the Chief of Engineers initiated application for International Joint Commission approval of the project but, as you know, the Canadian Government has stated officially that it is not prepared either to consent to an order of approval or to oppose the granting of such an order pending additional studies of the uses of the waters in Canada, including possible diversions.

House Document 531 considered a large number of potential projects for the development of the Columbia River Basin in the United States. Based on an appraisal of these projects and the need both present and immediately foreseeable at that time, for flood control, navigation, power, and other water uses, a main-control plan was developed.

This comprehensive study resulted in a sound plan which has formed the basis for material development of the basin in recent years, both by the Federal Government and by non-Federal interests. While the plan is still sound today, 8 years later, it became apparent a year or two ago that it should be reviewed, for a number of reasons. The more important of these were:

1. The need to consider Canadian storage in view of the increased prospect that it might be developed early.

2. The necessity of studying an integrated hydrothermal system as the cost of hydro projects increased and the efficiency of steam plants improved markedly, also because estimates of future load repeatedly were increased, indicating that more thermal-generated power would be required than originally contemplated.

3. Storage sites planned in 1948 became not available, for a variety of reasons.

4. Rapid development of atomic electrical generating techniques warranted a reappraisal of the system.

The Congress by resolution of July 28, 1955, requested the Chief of Engineers to review House Document 531 to determine whether any modification should be made in the plan of development contained in that report. This review is presently underway, and if sufficient funds are appropriated, is scheduled for completion late in calendar year 1957.

Now, Mr. Chairman, I would like to present a more detailed picture of the House Document 531 plan of development as it pertains to flood control and power.

FLOOD CONTROL

Let us first consider flood control. The three largest floods of record on the Columbia River occurred, in order of magnitude, in 1894, 1876, and 1948. These floods produced crest discharges at The Dalles of 1,240,000 cubic feet per second, 1,020,000 cubic feet per second, and 1,010,000 cubic feet per second, respectively, which may be compared with the maximum flood of record on the Missouri River near its mouth of less than 700,000 cubic feet per second. The 1948 flood caused damages totaling in excess of $100 million, and it has been estimated that recurrence at that time of the historical flood of 1894 would have caused damages amounting to more than $200 million to developments along the Columbia River below McNary Dam. Because of the extensive development that has taken place since 1948, and increased dollar values, the same flood today would result in substantially greater losses.

House Document No. 531 proposed a main control plan for the Columbia River Basin which included upstream storage for regulation of flood flows on the main stem and on several of the major tributaries with a view to controlling flood of the magnitude of the 1894 flood to 800,000 cubic feet per second, at The Dalles. Below The Dalles protection to a flow of 800,000 cubic feet per second can be provided reliably to a major portion of the flood plain by levees. House Document No. 531 recommended the improvement of existing levees in the lower river area to provide this assured protection against flows up to the controlled 800,000 cubic feet per second. It also recommended construction of new levees at several locations. Of the 26,990,000 acre-feet of storage included in the main control plan recommended in House Document No. 531, a total of 20,890,000 acre-feet was used to control the 1894 flood. Of this amount of usable storage only 4,890,000 acre-feet is available today, located as follows:

Hungry Horse on the South Fork of the Flathead River in Montana, 2,100,000 acre-feet; Grand Coulee, on the Columbia River in Washington, 1,200,000 acre-feet; Palisades, on the Snake River in Idaho, 1,200,000 acre-feet; and on the Payette River and Boise River in Idaho, at several locations, 390,000 acre-feet, totaling 4,890,000 acre-feet.

This existing storage would reduce the 1894 flood, if it were to occur today, from 1,240,000 cubic feet per second, to 1,110,000 cubic feet per second at The Dalles, for a stage reduction of 2 feet on the Vancouver gage.

Hungry Horse Dam has been completed to provide full control of the South Fork of the Flathead River and material benefits downstream. Grand Coulee Reservoir is only partially effective because of inadequate means of evacuating storage as a flood appears imminent or passing the early part of the flood in order to hold the storage space available to capture the flood crest.

With improvement of the outlets, as proposed, an additional 3 million acre-feet could be obtained for a total of 4,200,000 acre-feet, all of which is 100 percent effective at The Dalles. The Palisades project on the upper Snake River, the Cascade project on Payette River, and the three Boise River reservoirs would provide substantial local benefits and reduce the flood crest on Snake River above the Salmon River to about half its estimated 130,000 cubic feet per second natural discharge.

On the remaining storage proposed in House Document No. 531, the present outlook shows reasonable prospects for only 5,500,000 acre-feet. This includes the 3 million acre-feet at Grand Coulee I mentioned; 500,000 acre-feet each at Priest Rapids and John Day, and 1,500,000 acre-feet on the middle Snake at the licensed Brownlee project and the proposed Pleasant Valley project.

With this total storage of 10,300,000 acre-feet, which is shown on table 1, with which you have been provided, the 1894 flood could be controlled to about 920,000 cubic feet per second at The Dalles.

Table 1 also shows potential additional projects totaling 15,600,000 acre-feet of usable storage. The recommended Clearwater projects would provide 3,730,000 acre-feet. This storage would eliminate over 90 percent of the flood damages in the Clearwater Basin as well as provide material control of the Clearwater flood flows in the interest

of the lower Columbia River. The authorized Libby project on the Kootenai River in Montana would provide 5,010,000 acre-feet, which would control flood flows in that stream, both in the United States and Canada.

With the addition of Libby there would be sufficient storage above Grand Coulee to provide an additional 1,030,000 acre-feet of storage in Franklin D. Roosevelt Lake (Grand Coulee Reservoir) for use during the crest of a flood of the magnitude of that which occurred in 1894. The remaining projects are those under consideration in the current Columbia review investigation for which preliminary appraisals indicate favorable economics and feasible acceptance by local interests. Although the total amount exceeds the deficiency required to complete a plan comparable with the main control plan of House Document 531, it may be expected that valid objections will remove some of the projects from the list. If they were all obtained, however, the total 25,950,000 acre-feet of usable storage would control the 1894 flood to about 740,000 cubic feet per second at The Dalles.

Although existing levees protect some 96,500 acres of the 170,000 acres in the lower Columbia River flood plain, these levees were constructed over a long period by various local organizations. Although improved at many locations following the 1948 flood, the original design and construction criteria were inadequate in many cases, and the degree of protection provided by some of these levees is problematical. The number of failures or near failures that occurred during the 1948 flood are evidence of this deficiency. Part of the main control plan in House Document 531 involved raising and strengthening these levees where necessary to provide assured protection against the controlled flow of 800,000 cubic feet per second at The Dalles. Work has been authorized on 26 out of 29 existing projects. To date no work has been done by the Federal Government, although 2 improvements have been completed by local interests; 6 new projects were also authorized pursuant to studies contained in House Document 531, but none has been constructed to date. Review of the improvements previously proposed has revealed that increased costs have made several of questionable economic feasibility, and further study is necessary before construction is initiated.

The average annual flood drainage in this lower river area would amount to about $31 million without protection from either levees or storage. Under current conditions the levees provide assured protection evaluated at $10 million and existing storage may be credited with an additional $5 million benefit. Protection provided by the levees of uncertain reliability has been evaluated at $4 million annually, leaving annual damages under the current situation of about $12 million. With levee improvements proposed but without additional storage, the damages could be reduced to about $9 million annually.

This damage will occur on approximately 25,000 acres of cropland and 13,000 acres of urban and industrial lands which are not feasible of protection by levees alone. Addition of storage to reduce the 1894 flood to 800,000 cubic feet per second in combination with the levee improvements would reduce this damage to about $3 million annually as well as make firm the uncertain protection provided now by the levees which are high enough but of questionable strength. Reduction of controlled flows to 700,000 cubic feet per second would reduce

the annual damage an additional $1 million. The remainder occurs at lower flood flows down to approximately 350,000 cubic feet per second.

It may be seen from the above that additional storage and resulting reduction of flood stages in this area will produce additional benefits which are not obtainable any other way. With greater control it is possible that additional new levees will be found warranted, and no doubt the cost of such work accomplished after storage is provided will be generally reduced.

Possible Canadian storage, because of its remote location with respect to the major areas of flood damage in the United States, would not be as effective in controlling floods as most storage in the United States. Although agreements may be established to provide for operation of Canadian projects for maximum overall flood control and power benefits, the predominant Canadian interest may well preclude obtaining the same degree of benefits to the United States as would be possible where operation can be handled directly as necessary to meet immediate conditions.

POWER

I shall now proceed to a discussion of the hydroelectric power phase of the development problem. Since the major floods of the Columbia River and its principal tributaries are caused by the spring snow melt and generally occur in May or June, the use of storage capacity for flood-control purposes is fully compatible with the use of this stored water for the generation of power during the critical power period which extends from September to April.

This is not true of those tributaries west of the Cascades, such as the Willamette, but the winter rainfall floods of these streams and those which do occur occasionally on the streams east of the Cascades come when the Columbia River is generally low and do not cause damage outside their individual basins.

Any plan then to provide flood-control storage in the Columbia River Basin is also concerned with the generation of hydroelectric power, and it is fortunate that the large power benefits so obtainable assist materially in the justification of the storage capacity for both flood control and power. Without power to bear a large part of the cost of the parts of projects jointly serving power, flood control and navigation, much of the presently authorized flood control and navigation projects could not be economically justified.

In House Document 531, various levels of hydroelectric power development were considered taking cognizance of the continually growing demand for additional power supply in the region. Projects of the main control plan, including the run of river navigation projects of the lower Snake and Columbia Rivers, provided for a total installed capacity in excess of 11 million kilowatts. Pertinent data on these projects are given on table 2. You have a copy of that table at the end of my prepared statement.

As of mid-1955 the Federal power system in the Northwest power pool had in service a total of 3,589,000 kilowatts, or slightly in excess of 50 percent of the power pool total, or 29 percent of the total installed capacity in the Pacific Northwest, including all utilities in the region. The Federal projects under construction will add an additional 3 million kilowatts by 1961. In addition, 11 projects are under construc-

tion by non-Federal interests to provide new capacity of 930,000 kilowatts.

The future load growth of the region has been estimated by the Federal Power Commission as follows:

In 1955, average 5 million kilowatts; peak, 7 million kilowatts.

1975, average 16 million kilowatts; peak, 24 million kilowatts.

1995, average 35 million kilowatts; peak 56 million kilowatts.

2000, average 41 million kilowatts; peak, 65 million kilowatts.

Although it has been estimated that the Columbia River Basin has a total hydroelectric potential of some 35 million kilowatts, or 40 percent of the total available in the United States, it must be recognized that all of this potential cannot be obtained because of unavoidable conflicts and interference and because of economic limitations. To compare with the estimates of needs I have just given you, the following gives an indication of the hydro development potential for the Pacific Northwest.

The maximum potential, average 19 million kilowatts; peak, 45 million kilowatts.

Practical limit, average 12,500,000 kilowatts; peak, 28 million kilowatts.

This comparison indicates the probable need for sizable amounts of thermal power in the relatively near future. Additional hydro generation cannot be justified economically beyond the point where it exceeds the cost of thermal generated power. There will be a considerable period, however, after a significant amount of thermal power capacity is incorporated into the system, when additional units will be warranted at existing plants to provide added peaking capacity and thermal replacement energy for periods of higher flows.

In the immediate future, the addition of storage to provide greater regulation and increased prime power will call for some expansion of existing plants. As the amount of storage added to the system increases, however, it must regulate the runoff to provide increases in minimum power flows for longer and longer periods.

With the extension of the use of stored water to cover longer deficient periods the incremental gain in flow for each additional unit of storage decreases to the point that the amount of added prime or average continuous power which can be obtained is insufficient to justify economically the large amount of storage required. With the addition of thermal power to continue the increase in prime generation, the need for additional peaking capacity also grows to the point that it will be more economical to retain the stored water in order to keep the reservoir high and permit the hydro plants to be operated at full capability rather than draw the water out for the generation of energy and thus through the reduced head reduce the capacity of the units.

These factors combine to reduce the value of future storage as well as the value of present storage at some future time. The addition of units at the run of river plants, both to permit utilization of higher regulated flows and also to provide economical peaking capacity in the future hydrothermal system has been recognized, and in conformance with the planning indicated in House Document 531 provision is being made in current construction of the Corps of Engineers and others to provide for future expansion of all powerplants. That is the reason

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that although only 16 units are currently needed and can be economically justified at the Chief Joseph project, provision has been made and considerable construction has been accomplished for a future 27-unit powerhouse.

Similarly at The Dalles, the initial installation will be 14 units while the substructure is being provided for a total of 22 units. Space is available in both cases for further expansion, if necessary, as it is also available at McNary. One limiting factor in the extent to which such expansions can be made, in addition to cost, is the requirements of navigation, fish, and facilities constructed along the river. This will be a particular item of concern in the current study which must anticipate the future hydrothermal system.

Before any analysis can be completed of a water-resources development plan for the Columbia Basin within the United States, it will be necessary to analyze the effect of prospective developments in Canada and to evaluate the benefits to the United States that can be achieved by coordinated development of the water resources available in both countries.

Since neither country can expect to proceed independently of the other and be assured of the optimum benefit being obtained, the possibilities of joint progress must be considered by each. Similarly, however, before either country can enter intelligently into a study of what coordinated development can provide, what it will cost, and what the benefits are that are to be shared, studies must be made to determine the alternative costs and benefits resulting from a more nationalistic consideration of what can be done independently.

This is recognized by the Chief of Engineers and studies of the capabilities for development in the United States are being pressed to the end that the full extent of the benefits to be derived by projects within the United States and their cost, both in money and their effect on other resources, can be determined and fully understood.

In the meantime, the Canadian studies are continuing by the Canadian Government. At such time as sufficient information is available to permit analysis of the prospective Canadian development it is the intention of the Corps of Engineers to analyze its effect and worth to the United States. Such study may well serve as a basis for consideration by both Governments. In any event, complete analysis of the flood control, power, and other benefits that could be realized in the United States by Canadian developments, compared with jointly developed and alternative United States potentialities will furnish a sound basis for final negotiations by the United States with Canada.

Studies which are now actively underway by the corps are being directed toward the evaluation of storage in the future as a part of our fundamental economic considerations.

A preliminary study has been made by the Federal agencies concerned of possible benefits in the United States of proposed storage developments in Canada at Mica Creek and Arrow Lakes. These studies indicated that such storage would provide benefits in the United States. The amount of such benefits, however, would depend upon the manner in which these projects are operated and upon the extent of developments in the United States. The value of the Canadian storage in these projects would diminish rapidly with the devel-

opment of additional storage or additional thermal capacity in the United States.

I hope that the results of the current Canadian effort will be available in the near future. This would be of material benefit to the Corps of Engineers in facilitating its current assignment, and more important it would permit immediate progress on projects in both countries which would be of great value to the people of both the United States and Canada.

Mr. Chairman, that completes my statement.

Senator NEUBERGER. General Itschner, thank you very much.

The tables at the end of your statement will be included in the record, of course.

(The tables referred to follow:)

TABLE 1.—*Flood-control storage, Columbia River Basin, main control plan*

[Acre-feet]

	H. Doc. 531, main control plan		Existing	Present outlook, usable flood-control storage		
	Total usable storage	Storage used to control 1894 flood		Total immediate prospect	Recommended	Under consideration
Palisades, Snake River	1,200,000	1,200,000	1,200,000	1,200,000		
Boise River [1] / Payette River [2]	2,900,000	690,000	300,000	390,000		300,000
Hells Canyon, Snake River	3,280,000	2,600,000		[3] 1,500,000		
Libby, Kootenai River	4,250,000	3,900,000				5,010,000
Hungry Horse, South Fork Flathead River	2,980,000	2,100,000	2,100,000	2,100,000		
Glacier View, North Fork Flathead River	3,160,000	1,800,000				
Grand Coulee, Columbia River	5,120,000	5,100,000	1,200,000	4,200,000		[4] 1,030,000
Priest Rapids, Columbia River	2,100,000	2,100,000		500,000		
John Day, Columbia River	2,000,000	[5] 1,400,000		500,000		
Bruces Eddy, Clearwater River					1,430,000	
Penny Cliffs, Clearwater River					2,300,000	
Buffalo Rapids, No. 4, Flathead River						560,000
Improved outlet, Flathead Lake						500,000
Spruce Park, Middle Fork, Flathead River						300,000
Smokey Range, North Fork, Flathead River						1,500,000
Nine Mile Prairie, Blackfoot River						600,000
Long Meadows, Yaak River						150,000
Enaville, Coeur d'Alene River						600,000
Chiwawa, Wenatchee River Basin						150,000
Marsing, Snake River						830,000
Rays Ferry, Grand Ronde River						300,000
Total	26,990,000	20,890,000	4,890,000	10,390,000	3,730,000	11,830,000
Total potential additions					15,560,000	
Total, immediate and potential additions					25,950,000	

[1] Includes Anderson Ranch, Arrowrock, and Lucky Peak.
[2] Includes Cascade and Garden Valley.
[3] Based on licensed Brownlee project and proposed Pleasant Valley project.
[4] Additional storage at Grand Coulee that could be used for control of 1894 flood with upstream regulation of inflow provided.
[5] 2 million acre-feet could have been used if necessary.

TABLE 2.—*Power development, Columbia River Basin, main control plan (H. Doc. 531)*

Project	River	Usable storage	Installed capacity	Status
		Acre-feet	*Kilowatts*	
Hungry Horse	South Fork, Flathead	2,980,000	300,000	In operation.
Glacier View	North Fork, Flathead	3,160,000	210,000	Opposed by conservation interests.
Libby	Kootenai	4,250,000	588,000	Initiation of construction depends upon negotiations with Canada.
Albeni Falls	Pend Oreille	1,140,000	42,600	In operation.
Grand Coulee	Columbia	5,120,000	1,944,000	Do.
Chief Joseph	do		1,280,000	Under construction—in partial operation.
Priest Rapids	do		1,219,000	License granted to Grant County PUD, No. 2.
Hells Canyon	Snake	3,280,000	980,000	Alternate plan licensed to Idaho Power Co.
Lower Granite	do		220,000	Not started.
Little Goose	do		260,000	Do.
Lower Monumental	do		240,000	Do.
Ice Harbor	do		260,000	Under construction.
McNary	Columbia		910,000	Under construction—in partial operation.
John Day	do		1,105,000	Not started.
The Dalles	do		980,000	Under construction.
Bonneville	do		518,400	In operation.
Total		19,930,000	11,057,000	

Senator NEUBERGER. I just want to note before I ask a few questions that Senator Scott, the junior Senator from North Carolina, is here, that Senator George D. Aiken, of Vermont, who is a member of the Senate Committee on Foreign Relations, was here briefly and then decided to go to other committee meetings because we are concerned not with his own St. Lawrence interests but with the Columbia interests on the other side of the country. I indicated to Senator Aiken that we would note that he had been in attendance. And now in attendance, also, as a member of the Senate Committee on Foreign Relations, is the senior Senator from Oregon, Senator Morse.

I would like to ask you a couple of questions, if I may.

If this basin were to be treated as a unit, just forgetting the international boundary—after all, when God Almighty created these rivers He didn't know anything about "54 40 or fight" and then the ice age came down and created the canyons through which the rivers flow—what would be the sequence of the next projects to be constructed, in your opinion?

General ITSCHNER. That is a very difficult question to answer offhand. I am sure that the report which is now underway, which will be completed the latter part of 1957, would indicate the answer to that question. But based upon my limited knowledge of the Mica Creek project, I dare say that probably Libby Dam might be No. 1 and possibly Mica Creek, No. 2.

Senator NEUBERGER. In other words, if there were no international considerations, no boundary, and this were all one country, whether the United States or Canada or some other name, those two would be in the sequence you mentioned, Libby first and Mica Creek second, would be perhaps the most desirable schedule.

General ITSCHNER. That is my offhand opinion, sir. Mica Creek is not especially desirable from the standpoint of flood control. It does have flood-control benefits, but not as great as some of the other

reservoirs. Libby does have flood-control benefits, particularly immediately downstream, which are vitally needed.

Senator NEUBERGER. Mica Creek is chiefly beneficial, in your opinion, from the standpoint of hydroelectric power, then?

General ITSCHNER. That is correct.

Senator NEUBERGER. General, a little longer question I would like to ask is: On page 10 you referred to the fact that in adding thermal power, the whole question of its value and everything is in the sequence of projects. Also on page 12 of your testimony you said that the amount of such benefits would depend upon the manner in which these projects are operated and upon the extent of developments in the United States.

In other words, you laid reliance on the sequence of projects as to value both of thermal power and of the developments in Canada. The reason I am asking this question, and then I am going to relinquish you to my distinguished colleagues here, is this: When I was in Canada last October for 2 weeks—and I hope when ex-Governor Jordan is recalled I can ask him about this—I found that many Canadians believe that the Parliament for the first time had taken up the proposed diversion partially because of statements made by Mr. Jordan, ex-Governor Jordan, representing the International Joint Commission, that these Canadian projects might have relatively little benefit in view of additional projects which he believed would be built in the United States.

Some of that feeling, not so forthrightly as Governor Jordan has said, is indicated in your statement here.

All this is a preface to ask you this question which I think is a sort of $64,000 question about the Canadian diversion and everything else.

When Governor Jordan says to a meeting of the International Joint Commission and to General McNaughton, "Your storage up in Canada won't have a great deal of value to us if we have this storage which we contemplate at various sites in the United States, and when we have thermal power, the value of Canadian storage will diminish," do you of the Army engineers take into consideration the controversial aspects of some of the proposed sites in the United States?

Of course I recognize this is a long question, but I want to give you the background of why I am asking it.

For example, do you take into consideration things like this? In your table 2 you list Hells Canyon, 3,280,000 acre-feet. Yet you and I know that there are projects under construction at Hells Canyon which will not have 3,280,000 acre-feet. Do you also take into consideration the fact that Glacier View is listed for approximately the same storage as Hells Canyon, yet that a project at Glacier View would encounter probably some of the same objections that the proposed Echo Park project encountered which resulted in its elimination from the upper Colorado storage project.

Do you take into consideration the fact that the proposed projects at Bruces Eddy and Penny Cliffs—I believe Bruces Eddy is recommended in the President's budget—do you take into consideration the fact that they are under heavy controversy from sportsmen's groups?

This is a very long question, but the point I am trying to get at is, when my assistant and I talked to Members of Parliament they felt that the reason the Parliament had provided the appropriation to

study the diversion was that they had heard from General McNaughton that ex-Governor Jordan believed these Canadian projects would become of very little importance to the United States as we built up all our own storage in the United States. I can't ask you to comment for Governor Jordan, but do you of the Army engineers, General, when you are outlining this sequence and this schedule take into consideration the fact of what has happened at Hells Canyon and of the heavy controversy involving sites like Bruces Eddy, Penny Cliffs, and Glacier View?

General ITSCHNER. That is a series of long questions, Senator.

Senator NEUBERGER. I wanted to give the background.

General ITSCHNER. I shall try to answer them as I recall them.

In the first place, it is a definite principle that the first increment of storage is worth more than the next like increment in any basin at any time. Consequently, if storage is provided today and an additional amount of storage of equal amount is provided 10 years from now, the storage which is provided today is worth considerably more than the future storage. That is true for both flood control and for power development.

So regardless of whether the storage is in Canada or in the United States, that same principle applies. It is what we call the first added basis.

I think that Governor Jordan is correct in saying that Canadian storage, wherever it is located, will be worth less as additional storage is added in the United States, if it is added.

The second question which you asked was, does the Chief of Engineers take into consideration the opposition to reservoirs at the time we consider them for construction. The answer is definitely "Yes." In the case of Glacier View, which is a reservoir proposed by certain interests and considered by the Corps of Engineers in House Document 531, located on the North Fork of the Flathead River in Montana within the confines of Glacier National Park, the corps did not recommend that project because of the opposition of wildlife interests. On the other hand, we have recommended Bruces Eddy and Penny Cliffs projects on two different branches of the Clearwater River in Idaho because we must have storage on the Clearwater River if we are to control floods on that river and if we are to control them to the desired degree on the Columbia, because the Clearwater River is a river which is completely uncontrolled at this time, and it is a river which contributes heavily to the larger floods on the Columbia River.

We recognize that there is some damage to wildlife values at Bruces Eddy and Penny Cliffs. We have made a great effort to try to find out exactly what those values are. We have come to the conclusion that they are not very great. We cannot help but think back to the situation which occurred in New England this past summer. Up there in New England we had recommended a number of projects, and they have been authorized for a good many years. There was opposition to the construction of each of those projects, mostly because the people who lived in the reservoir areas were being harmed and therefore they would not permit the construction of these reservoirs. But when the floods occurred, there was a good deal of fingerpointing at many people, a little bit of it at the corps, and the opposition died completely.

We feel that while there are some harmful effects in all of these reservoirs, nevertheless we are going to have to accept some of those damages in the interest of the overall good. We feel that is definitely true of Bruces Eddy and Penny Cliffs, particularly Bruces Eddy, where the damages to the fish are really quite unimportant as we compare them with other dams, and the alleged harmful effects to the elk heard are problematical and, insofar as we have been able to determine, not very serious.

Senator NEUBERGER. The one thing I wanted to establish definitely is that the claim that Canadian storage might have a diminished value is entirely presumptive upon these other projects first being built in the United States, is it not?

General ITSCHNER. Not 100 percent that, sir, as I am sure you recognize. It is dependent upon two things: First, the assumption that there will be storage in the United States and, secondly, that there will be incorporated into the system thermal-generated power, which has much the same effect as incorporating storage into the system. So as the thermal-generated power is increased the benefits from Canadian storage or American or any other storage will likewise decrease.

Senator NEUBERGER. Thank you very much, General.

Before I ask the other Senators if they wish to ask questions, the staff has indicated to me, as I should have announced earlier for the convenience of all present, that our schedule today will be to recess at noon and to reconvene at 2 o'clock and go into 4 o'clock. That is just in case anybody wants to base his schedule on that. I understand I am supposed to ask the host committee first and the guest committee second if they want to ask questions. So, Senator Scott, do you have any questions you would like to ask General Itschner?

Senator SCOTT. I will ask him when he gets on my river down in North Carolina.

Senator NEUBERGER. I do not know how we can get your river to Canada, Senator.

Senator Morse, do you have some questions you would like to ask General Itschner?

Senator MORSE. I have a few. I am sorry to be late, Mr. Chairman, but I lost my glasses yesterday and my reading at arm's length is because I am using long-distance glasses.

General, on March 14, 1956, Senator Neuberger, Congressman Green, and I wrote General Sturgis a letter. I think its contents are so important, Mr. Chairman, that they should be the basis of the discussion here this morning. I am going to read the letter.

DEAR GENERAL STURGIS: The March 1 Water Forecast Report of the United States Weather Bureau indicates the most probable range of peak discharge of the Columbia River near The Dalles, Oreg., during the coming snow melt runoff period will be 700,000 to 850,000 cubic second-feet. The flood threat imposed by such volume of water and the lack of upstream storage capacity to cope with it are cause for grave concern.

The peak discharge figure of 850,000 cubic second-feet forecast for the spring runoff on the Columbia River this year is in the neighborhood of the volume which caused 5 of the 10 worst floods in the recorded history of the basin. Recognizing that weather conditions which might prevail during the snow-melt period cannot be predicted with certainty, prudence requires the utmost consideration be given to the possibility that the flood peak might exceed the predicted range. Even if the flow is contained within the 700,000 to 850,000 cubic second-feet figures, it appears that many areas in lower elevations will be flooded.

We urge the Corps of Engineers to immediately undertake a survey to determine emergency measures that can be taken to prepare against the eventualities which are posed by the present flood threat. We would appreciate an immediate report on the adequacy of present flood control facilities to cope with a flood crest within the predicted range, and an estimate of work which could be accomplished during the next few months to provide better protection to meet expected eventualities. If, in your estimation, emergency funds are needed over and above amounts now available to the Corps of Engineers for flood-prevention work in the few months remaining before runoff, we would appreciate a summary of financial requirements so that appropriate congressional action can be sought.

It is regrettable that since the 1948 Columbia flood so little has been accomplished toward expansion of the basin's flood-control capacity through construction of storage dams. However, since the forecasts indicate that the region again may be visited by a flood of maximum volume, the short time remaining can be spent beneficially in improving facilities to meet a possible crisis. Please be assured of our cooperation in assisting the corps in its efforts to carry out plans to minimize pending flood problems.

Sincerely,

WAYNE MORSE,
United States Senate.
RICHARD L. NEUBERGER,
United States Senate.
EDITH GREEN,
Member of Congress.

The letter was dated March 14.

On March 19 we received the following reply from you:

DEAR SENATOR MORSE: This is an interim reply to your letter of March 14, 1956, which was also signed by Senator Richard L. Neuberger and Representative Edith Green, concerning the anticipated rise of the Columbia River in the vicinity of The Dalles, Oreg., during the spring runoff, and requesting action be taken in advance to provide facilities to meet possible damage from floods.

The Chief of Engineers is fully cognizant of the flood potential in the Columbia Basin this year, and shares your well-founded concern. You may be sure that every action possible consistent with existing legislation is being taken to prepare for the flood which might occur. Funds are available with which to finance any preparatory work which he is authorized to accomplish, realizing that his authorities are limited.

I have asked General Foote, division engineer, North Pacific Division, to make a full report on the matter, which I shall be pleased to furnish you as soon as it is received.

Sincerely yours,

E. C. ITSCHNER,
Major General, United States Army,
Assistant Chief of Engineers for Civil Works.

We look forward with great interest to General Foote's report.

I understand why you could not say more in that letter, but that letter isn't of much solace to the danger which confronts us out there because we have to find out specifically what is being done and what your proposals do.

Now, Mr. Chairman, I want to put in the record an article from the Oregonian, Thursday, March 15, 1956, under the heading "River Studies Show Possibility of Flood Worse Than 1948 Disaster." If I may, I would like to have the entire article printed at this point in the record.

(The article referred to follows:)

[From the Oregonian, March 15, 1956]

RIVER STUDIES SHOW POSSIBILITY OF FLOOD WORSE THAN 1948 DISASTER

(By Leverett Richards, staff writer, the Oregonian)

The flood of 1956 could be worse than the disastrous Vanport flood of 1948, river studies show.

The flood crest depends upon a number of factors, including spring temperatures and precipitation over the whole basin, but the potential so far this year is as great as 1948, if not slightly greater.

The peak flow at The Dalles could be as much as 1,050,000 cubic feet per second this spring, the Corps of Engineers points out. The peak in 1948 was 1,010,000.

That does not necessarily mean the crest this spring will be higher than the crest in 1948, the engineers explain. Grand Coulee and other reservoirs which were not used for flood control in 1948 will be used this spring under an agreement just completed by the north Pacific division of the Corps of Engineers. These reservoirs will take from 1 to 2 feet off the normal crest.

That still leaves a forecast of 25- to 28-foot crests at Portland and Vancouver, compared to the 29.9-foot crest April 1, 1948.

But Vanport was wiped out in a matter of minutes by a flood crest of 27.5 feet, and half a dozen other dikes up and down the river broke at lower levels.

With one eye on the 1948 record and the other on snowfall depths which set new records for March in many parts of the Columbia River Basin, the Corps of Engineers already has started fighting the expected floods through the length of the Columbia and its tributaries.

Dikes and leeves in the Portland district have been surveyed. Sector engineers in the Walla Walla and Seattle districts will be in the field soon checking the Columbia and tributaries throughout their lengths. While drainage districts are responsible for maintenance on most dikes, the engineers are responsible for inspection.

Supplies of sandbags have been checked at commercial supply houses and found adequate. Arrangements have been made for quick mobilization of heavy equipment from contractors for use on dikes and levees when needed.

An emergency evacuation plan has been adopted by military agencies at Portland International Airport. Transport planes and pilots of the 403d Troop Reserve Wing have been alerted for emergency duty to haul sandbags, men, and equipment to meet flood emergencies anywhere in the Northwest.

ONE DIKE NEWS

Why the evacuation plans? It may come as a shock to some to discover that the Portland area is no better prepared to cope with a flood of 1948 proportions now than it was 6 years ago, except for 1 new cross dike built primarily by the Reynolds Metals Co. to protect its Troutdale plant.

The railroad fill which blew out without warning the afternoon of Memorial Day, Sunday, May 30, has been patched. "There is no guaranty adjacent sections would not give way under similar conditions. This is a railway fill, not a levee or a dike," the engineers bluntly declare.

Cause of the sudden breach in the railway fill never has been fully determined.

Denver Avenue, which washed out in 1948, has been repaired and widened, but is not designed to serve as a dike. The same is true of Union Avenue.

The pumphouse on Peninsula Drainage District's levee has been restored and improved. The levee has been repaired to provide the same degree of protection formerly provided.

The same is generally true of the levee along the Columbia from the mouth of the Sandy River to the Spokane, Portland & Seattle Railway Co. bridge. None of these dikes or levees has been raised, widened, or added to.

These emergency repairs, together with floodfighting and rescue work, cost the Corps of Engineers $5,125,000.

The engineers, in cooperation with other agencies, has prepared a plan which would improve the area's defenses against Old Man River—at a cost of some $57,817,200. These projects were authorized in 1950, but no funds have been appropriated to accomplish any of them.

This authorized plan includes $15,693,100 for improvements to existing dikes and levees; $3,719,100 for new dikes; $7,380,000 for bank protection on the Columbia from the Sandy to Willamette; and $26,900,000 for a new seawall for Portland's waterfront.

Three cross dikes are proposed in these authorizations for the protection of Portland's airport, which was knocked out by the 1948 flood. One would be near the new pumphouse, another at about Northeast 94th Avenue; the other at about Northeast 140th, as shown on accompanying map.

With the Weather Bureau forecasting a runoff at The Dalles, 33 percent above normal, the engineers are preparing for peaks well above flood stage at Bonners Ferry, Idaho; Missoula, Mont.; St. Joe and St. Mary's, in Idaho; Tonasket, Wash.; Cle Elum, Wash.; Wilson, Wyo.; and Heise-Roberts, Idaho, on the Snake.

COULEE IN NET

In the absence of any additional major flood protection since the $100 million freshet of 1948, the engineers are counting heavily on full use of all dams in the Columbia Basin to reduce the crests as much as possible.

Grand Coulee, a Bureau of Reclamation dam designed and operated for power and irrigation, this year will be operated under an agreement to provide 1,238,000 acre-feet of reserve storage for flood control, Col. Charles D. McDaniel, executive officer of the North Pacific Division, Corps of Engineers, said. The reservoir will be held at 1,274 feet (above sea level).

Installation of outlet gates of greater capacity would greatly increase the flood-control potential of the dam, engineers say, but this project has not been funded.

Hungry Horse, on the Flathead River, 1 dam on the Yakima River, and 3 on the Boise (Lucky Peak, Anderson Ranch, and Arrow Rock) will all be operated for maximum flood control, making another 1 million acre-feet of storage available, the engineers stated.

Senator MORSE. My mail shows, Mr. Chairman and members of the committee, that we are playing with a risky gamble in the Pacific Northwest at the very hour that we sit in this committee room. We must start putting in a flood-control program in my judgment if we are to prevent the very strong probability of some terrible losses.

All you have to do is take a look, General, at the snow-pack figures supplied to me under date of March 23, 1956, which I took from the Senate Committee on Interior and Insular Affairs March 23, 1956, figures supplied by the United States Geological Survey:

(The following letter is included here by request of Senator Morse:)

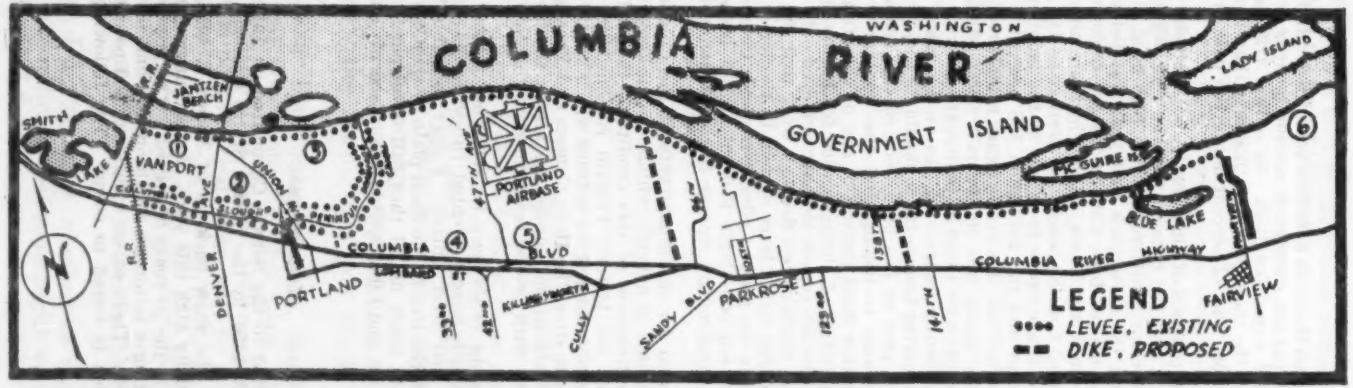
UNITED STATES SENATE,
April 3, 1956.

Re upper Columbia Basin hearings.

Hon. JAMES E. MURRAY,
Chairman, Senate Interior Committee,
United States Senate, Washington, D. C.

DEAR SENATOR MURRAY: On Monday, March 26, I introduced into the record a table showing the water content of the snow pack as of March 1 on various courses in the Columbia Basin, in percentages of the 1938–52 average figures. General Itschner, Assistant Chief of Engineers, commented that these figures are "about comparable" to the figures for the 1894 flood, which as you know was the greatest on record.

Since Monday I have obtained the figures of the snow pack as of April 1, 1948, which in June 1948 produced the second greatest flood on record and the terrible disaster when Vanport, Oreg., was wiped out. I wish to submit these figures in a revised table to replace the table introduced Monday, since the comparative figures for both years are so much more significant than those for the single



Artist's sketch shows existing levees required after 1948 flood, but not extended or strengthened. Dashed lines show dikes proposed but never built. Dike at Fairview was built by Reynolds Metals Co. and drainage district year ago. Figure 1 marks Vanport and railway fill; 2, racetrack between Denver and Union Avenues; 3, Peninsula drainage district and pumphouse; 4, Colwood golf course; 5, airbase; 6, Reynolds aluminum plant, only one to escape 1948 flood.

year. I also request that this letter be placed in the transcript to precede this table.

I should like to comment on the table herewith submitted. In the upper Columbia Basin above the Kootenai the snow-pack measurement is more than 10 percent above the comparable figure for 1948. In only 1 tributary between the Kootenai and the Snake is the snow pack less this year than it was in 1948, and in the other 9 it varies from 2 to 72 percent above the pack which resulted in disaster that year.

The Snake River Basin consists of three major watersheds, the Snake itself with its minor tributaries, and the Salmon and the Clearwater. Of the three the Snake was the least serious contributor to the 1948 flood, simply because of the happy coincidence that the snow pack that year was below normal almost throughout its watershed above Hells Canyon, as the table indicates; in the first 12 courses listed in the Snake Basin, all of which are above Hells Canyon, the snow-pack figures ranged from 82 percent of average to 117 percent. On the same courses this year no single figure is as low as the maximum for 1948, the minimum being 120 percent and the maximum 158 percent. On the Salmon, which was a heavy flooder in 1948, this year's figure is 20 percent above the 1948 level. On the Clearwater, which was the basin's worst offender in 1948, the figures this year are identical with those of that year.

This situation is tremendously dangerous. In an age when we have all the technical ability and engineering knowledge to dominate these rivers and render such floods a thing of the past as has been done in the Tennessee Valley, we find ourselves reduced merely to hoping that the weather will be favorable so as to produce only a minor flood instead of one of catastrophic proportions.

Yet of the 27 million acre-feet of storage called for by the main control plan of the Army engineers in the 308 report, we have achieved only a bare 7 million. Under questioning General Itschner testified last week that the Federal Government has done nothing to add to its levee system in the lower Columbia Basin in recent years. Yet due to the present administration's Columbia Basin policy of no new starts there is not one single Federal project presently under construction which will add flood-control storage in the Columbia Basin above The Dalles.

Appalling as it may seem for the inhabitants of the Columbia Basin to be reduced to complete subjection to nature's whims, we all know that there is one major reason for the continuation of this condition—the abdication in favor of the private utilities of our historic Federal responsibility for river basin development. The partnership do-nothing policies which are selfishly attempting to destroy our great storage sites like Hells Canyon and Paradise by permitting private exploitation with almost no storage are killing the dream of what the mighty Columbia could be with proper management—the Northwest's greatest resource and friend.

This spring the Columbia Basin may be subjected to the penalties of the policies of obstruction which have prevented full-scale development of multipurpose dams for power and flood control. I pray that this bitter experience may be spared the people who live in the flood plain of the Columbia and Snake. The present threat should teach us all that full development of storage sites like Hells Canyon, Paradise, and Libby should be pressed with all possible speed.

With kindest regards,

Sincerely,

WAYNE MORSE.

FLOOD CONTROL

(This information supplied to the Senate Committee on Interior and Insular Affairs March 23, 1956, by the United States Geologic Survey)

The water content of the snow pack as of March 1, 1956, throughout the Columbia Basin is unusually high this year. Some courses contain more snow water than at any time in the 20 years of record. The ground throughout the basin is saturated, assuring a minimum of absorption and maximum of runoff during the melting period. There exists a serious flood potential even without the March snowfall which is bound to occur. The following table gives the

water content of the snow pack on the various courses in terms of the average for each course over the period of record:

Course	Apr. 1, 1948, percent of average	Mar. 1, 1956, percent of average
Upper Columbia (above Kootenai)	121	136
Columbia Basin above Snake:		
Kootenai	114	131
Clark Fork	142	137
Bitterroot	136	139
Flathead	120	125
Pend Oreille	110	156
Spokane	110	145
Okanogan	114	163
Methow	110	189
Wenatchee	112	148
Yakima	123	168
Snake Basin:		
Above Jackson Lake	89	158
Jackson Lake to Heise	91	124
Heise to American F lls	97	124
Southern Tributaries	96	120
Big Lost River	87	131
Big Wood River	82	129
Boise	89	135
Owyhee	100	120
Payette	96	132
Malheur	112	128
Burnt	117	132
Powder	116	130
Hells Canyon:		
Imnaha	118	156
Grande Ronde	121	143
Salmon	108	129
Clearwater	128	128
Columbia Basin below Snake:		
Walla Walla	132	120
Unmatilla	139	131
Crooked	131	120
Deschutes	128	139
John Day	131	141
Hood	160	120
Willamette	136	148

Senator MORSE. One of the representations which is being made out in my section of the country is that the Snake isn't much of a flood threat. Yet when I take a look at these snow pack figures and and notice the percentage and some of the tributaries which flow into the Snake, I am a little at a loss to understand why there should be such a minimizing of the Snake River as a contributor to flood dangers in my section of the country.

I will pass this over to you. Take a look at some of those percentages in the Snake Basin. Do you think they indicate flood danger?

General ITSCHNER. There is no question, Senator Morse, that they do indicate a great flood potential this year. As you know, it depends upon the weather that we get between now and the time the flood occurs. It is possible that there will be no serious flooding in the Columbia Basin, but the chances are quite good that there will be a flood. Whether it is a flood of record or whether it is just an intermediate flood we cannot tell at this time. The situation is serious in the Columbia Basin, and it is also serious in the Snake Basin as part of the Columbia.

Senator MORSE. Do you know whether or not it is true, as the record would seem to indicate, that snow packs were somewhat of those proportions in the 1894 flood?

General ITSCHNER. Yes. The snow pack was very heavy. I don't have the exact figures here. It was about comparable to this, I would say, prior to the 1894 flood.

Senator MORSE. These are March 1 statistics. They don't even include the snow of March. There has been some, I am advised——

General ITSCHNER. That is right.

Senator MORSE (continuing). Of no slight proportions. That leads me, General to this question: What are the present plans of the Army engineers with regard to the major flood control dams? Are you rewriting the 308 report? Are you eliminating the major flood control dams?

General ITSCHNER. No, sir. We are considering all of them. We are eliminating those which we consider are infeasible of construction due to objections of one type or another, such as Glacier View. That dam will probably not be in the new report. Otherwise, if we think there is some chance that they may be constructed over local objections, we are including them so Congress and the people can decide whether they want to accept the loss which is entailed in the construction of these projects and reap the benefits from the flood control acquired.

Senator MORSE. In the original 308 report Hells Canyon was included, and I understand one of the reasons was it was recognized that it would have flood-control storage value.

General ITSCHNER. That is correct, sir, it was included partly for flood control and partly for power.

Senator MORSE. Are the Army engineers still of the opinion that Hells Canyon Dam would be valuable as a flood-control dam?

General ITSCHNER. There is no question that it would be valuable as a flood control storage dam, sir.

Senator MORSE. Is not one of the reasons why you wanted to have a higher dam at John Day because of the possible contemplation that we might not have a storage dam at Hells Canyon?

General ITSCHNER. No, sir. The Hells Canyon Dam was considered in the 308 report, House Document 531, as was the higher dam at John Day. They were part of the integrated system and not mutually exclusive.

Senator MORSE. It is my understanding from the last report that the Army engineers were reluctant to eliminate the higher level of John Day even though it was represented to me when I made a personal investigation of the matter this last fall that the higher level at John Day would actually produce some supplemental effects up at McNary. It was told to me when I was at McNary that one of the reasons why the Army engineers were somewhat reluctant to yield on the recommendation for a lower level at John Day was because they were in doubt as to whether or not Hells Canyon would be built, and therefore that flood storage might be lost.

General ITSCHNER. We are very reluctant to yield on any of this storage any place because, as was brought out today, and as you know, I am sure, we have under 5 million acre-feet out of the total amount that we require, which is at least 21 million acre-feet assuming it is properly located in the basin.

So we were reluctant to yield that additional storage at John Day until we could see some prospect of replacing it some other place in the basin. We have now reported the John Day project as being desirable for storage of only 500,000 acre-feet, which is the lower elevation.

We have done so only because the people in that area do not like to see that flood-control surcharge which will make it difficult for them to utilize the navigational aspects of the river. We agree that is not desirable.

We are not too much concerned about its effect upon McNary Dam because the full capacity of that reservoir would be used only once in a great many years, maybe once in every 20 years, something like that.

Senator NEUBERGER. Along that line, as Senator Morse said, I remember when the hearing was held about the suggestion for revising the height of John Day, I believe that General Foote did comment at that time that one of the reasons he was somewhat disturbed about a lesser quantity of storage at John Day was the fact that Hells Canyon had been diminished or seemed to be diminishing as a storage project. I remember quite definitely that General Foote was quoted to that general effect.

General ITSCHNER. That certainly is true. It is of concern that we have lost storage at Hells Canyon, as it is at other places, like Priest Rapids where we have lost 2 million acre-feet. We gave up Glacier View in the beginning, but we wanted an alternative site for Glacier View, which has not been forthcoming. We are having the greatest of difficulties in getting additional storage any place in the basin.

Senator NEUBERGER. Could we put in the record at this point what the storage would be at Hells Canyon with a high dam and with the present proposed development and what it would be under the two programs at Priest Rapids?

General ITSCHNER. I am not sure I understand you.

Senator NEUBERGER. What it would be at Hells Canyon under the Idaho Power Co. program and under the proposed Federal dam in the 308 report, and you said you are losing some storage at Priest Rapids. I wonder if we could have the two.

General ITSCHNER. I could give you that information immediately, but I shall insert it in the record later to save time.

(The information requested follows:)

Comparison of storage presently contemplated at Hells Canyon and Priest Rapids as compared to storage contemplated in H. Doc. 531

	Storage contemplated, H. Doc. 531 (acre-feet)		Storage contemplated today (acre-feet)	
	Total usable	Used to control 1894 flood	Total usable	Used to control 1894 flood
Hells Canyon and vicinity, middle Snake River:				
Hells Canyon, high dam	3,280,000	2,600,000		
Brownlee (licensed by FPC)			1,000,000	1,000,000
Pleasant Valley (license applied for)			500,000	500,000
Total	3,280,000	2,600,000	1,500,000	1,500,000
Priest Rapids and vicinity, middle Columbia River:				
Priest Rapids, high dam	2,100,000	2,100,000		
Wanapum (licensed by FPC)			330,000	330,000
Priest Rapids, low dam (licensed by FPC)			170,000	170,000
Total	2,100,000	2,100,000	500,000	500,000

Senator MORSE. I wish to say two things, General. Being from Oregon, I appreciate your modification of the height of John Day.

Based on such evidence as I have seen, I think it was a sound decision. After I got through with the investigation that I made of the matter I was convinced that the higher dam should be modified.

I tell you this for what it is worth. I stood in the powerhouse at McNary Dam and the resident civilian engineer told me that if the higher dam were built at John Day the backwater would be such that it would come several feet within the powerhouse of McNary itself, which was very difficult for me to believe. I examined him at some length. I said, "Let me see if I got you straight. Do you mean to tell me if we build the higher level at John Day, the backwater storage will be such that, unless you do something here at McNary Dam to prevent it, it will come into this powerhouse?"

He pointed on the wall to an elevation of at least 4 feet.

General ITSCHNER. Your statement is correct, sir, with one bit of explanation.

Senator MORSE. Go ahead. Let's get the record straight.

General ITSCHNER. The elevation that he pointed out to you on the wall of the powerhouse is correct as far as the outside of the powerhouse is concerned, but the powerhouse is deliberately designed to withstand that head and the plan is that this 1 year in 20 or 50, whenever it occurs, that we must use that entire 2 million acre-feet of storage in John Day Reservoir, the openings would be bulkheaded up. That is part of a calculated plan, so it would be taken care of. Of course, it involves expense, time, and effort to take care of that bulkheading.

Senator MORSE. I can well understand your use of the language, but I want to say good naturedly I do not join in what would seem to be the irrevocable conclusion on your part that the storage at Hells Canyon has been lost. I would not want to sit here in silence and not register my reservation on that subject.

In your statement you say that—

possible Canadian storage, because of its remote location with respect to the major areas of flood damage in the United States, would not be as effective in controlling floods as most storage in the United States.

Doesn't this make the preservation of storage at Hells Canyon all the more important, therefore?

General ITSCHNER. The value of flood-control storage increases with its proximity to the point that you desire to protect. Hells Canyon is close to the points which we desire to protect, which are in the Columbia River Basin beginning at McNary Dam, but largely downstream from The Dalles. So the closer it is the more effective it becomes. We actually use a factor to apply against flood-control storage in various reservoirs. Some of it is 100-percent effective. I think the Hells Canyon factor of remoteness would certainly be 100 percent.

On the other hand, for Mica Creek and some of the other remote reservoirs we would use a factor of perhaps 65 percent for remoteness.

You have the other side of the question, and that is the fact that the Snake is already partially controlled. Consequently the principle which I announced earlier, of the first storage being the more valuable, obtains. Then each increment of storage on the Snake becomes less valuable as we go on to ultimate complete regulation of the stream.

Senator MORSE. General, I want to assure you that I do not want in any way to involve you in any discussion of the political aspects

of our resource development program in the Pacific Northwest. I want to direct my questions so you can testify on the engineering features. Let's take the overall so-called partnership program and the overall flood control, power, and other multiple-purpose programs of the 308 report, and answer this question: Is it true that the so called partnership program as it has been developed to date along with the lower head private utility dams not a part of partnership program would give us less storage than the carrying out of the 308 Report?

General ITSCHNER. The conflict, I believe, would occur in the Hells Canyon reach, and there it is true that the high Hells Canyon Dam has more storage than the alternative solution proposed by the Idaho Power Co. and by the projects downstream from the Hells Canyon Dam.

Senator MORSE. How about Paradise?

General ITSCHNER. Paradise likewise would have had more storage than the alternatives proposed.

Senator MORSE. I am very anxious to see what you do with the 308 report and I am concerned about some rumors as to what you may do with it, but let's assume for this discussion that 308 stands. Would you not find that the major flood-control dams over the years would clearly justify the cost that we have to put in them as taxpayers throughout the country from the standpoint of the losses they would save, particularly when we keep in mind the additional concentration of population which we can expect over the years in that section of the country?

General ITSCHNER. Yes. In our House Document 531 report we did not recommend any projects with flood control storage unless we felt that it was economically justified. As the years have gone by, we have certain evidence to indicate that our estimates were on the conservative side, both because of the increase in development in the flood plains at a much more rapid rate than we had anticipated, and also because of the devaluation of the dollar. The result is that we feel that all of our originally recommended flood-control storage projects for the Columbia Basin are well justified today.

Senator MORSE. Speaking hypothetically, if we could assume that all the major flood-control projects were in existence, would they prevent the kind of flood that we had in 1894 as far as the damage of that flood was concerned, or if it would not prevent it in entirety, how much of the damage would the entire system eliminate?

General ITSCHNER. It would have reduced the damage very greatly, based upon the flow of 800,000 second-feet at The Dalles for the 1894 flood.

Senator DWORSHAK. Will the Senator yield?

Senator MORSE. Yes.

Senator DWORSHAK. Does the Senator include in that question the flow of just the Snake River or all of the tributaries of the Columbia?

Senator MORSE. What they had involved in the 308 Report.

General ITSCHNER. It would reduce the damage to an average annual amount of about $3 million in the lower Columbia River area.

Senator MORSE. As compared with——

General ITSCHNER. An uncontrolled average annual damage of about $31 million.

Senator MORSE. That is why I take the position that we are dealing here with a problem which under the general welfare obligation of this Government of ours we cannot morally justify not doing it. It becomes a question of morals. It is so easy to forget them. This calls for translating into legislative action, it seems to me, just some moral principles; that is all. You can't stand by when you have an engineeringly sound program decade after decade permitting that human suffering when putting our engineering brains to work will prevent it. You can't do it, in my judgment, and call the Government a representative government in the interest of the people.

Let's get down to the flood area of this year, General, California and Oregon. Is it not true that the plans that you have in the Army engineers for the control of the floods on the rivers which caused so much damage this year in Oregon and California, if built, would likewise have greatly reduced that damage?

General ITSCHNER. Oh, yes; that is true. If they had been built, the damages along those rivers would have been relatively minor.

Senator MORSE. I don't care whether it is in the northeastern part of the United States or North Carolina or where it is, if we are to prevent that kind of human and property loss, it means we have to get on with the survey of these rivers, doesn't it, so you can submit to the Congress the survey reports which contain the recommendations as to what you think we ought to do?

General ITSCHNER. The surveys are the first and necessary step before we can get authorization, and then after authorization, of course, we need the appropriations to continue the program. In the case of New England we did have a number of projects which have been authorized for many years, but we have not received appropriations with which to construct them.

On the other hand, even if all of them had been built, there still would have been very material floods in many of the basins because not all the basins were covered by proposed projects.

Senator MORSE. Had you surveyed all of them?

General ITSCHNER. In some cases we had made surveys, but there was so much local objection that we were not able to recommend the construction of the projects. In other cases we recommended them and they were not authorized because of the very violent objection. After the flood much of that opposition melted away very rapidly.

Senator MORSE. You have not abandoned these projects as far as Army engineers' policy is concerned. Rather, you are waiting to see if you can get appropriations for them. Is that the case?

General ITSCHNER. That is correct, sir. There has been so much interest in both New England and California that we anticipate we will receive rather substantial appropriations this year to start many of those projects which have been on the shelf for a good many years.

Senator MORSE. In asking the next question I want you to understand I am completely impersonal and professional about it. I wholly appreciate the many problems the Army engineers have, but I am a little lost to understand why last year after Senator Neuberger and I wrote the joint letter to the Army engineers urging that you allocate some funds for survey of the Salmon, Coquille, and other areas down

there, the Klamath, Rogue, for which survey money was available, you didn't allocate those funds to complete those surveys. You had the money. I recognize the budget isn't set up so that the funds by act of Congress are allocated to a specific river, we will say the Coquille. That is within the discretion of the Army engineers. But the advice we were receiving was that the flood conditions in our part of the States will become progressively worse and that we ought to proceed with a survey so we could lay before the Congress specific projects that ought to be built.

The Army engineers did not allocate any funds to those rivers, and I don't believe that you have to date. You have a temporary program in there, but what we need on the Klamath, the Rogue, and the Coquille, yes, and the Yamhill and Calapooya, is surveys which will give the Representatives of Oregon, irrespective of party, the information they need to lay before the Congress what we ought to include in a flood-control program. Until we get those surveys, as up in the northeast part of the United States, there isn't much Congress can do. Is it a case that you haven't the staff or enough money or what is the problem which is preventing the completion?

General ITSCHNER. The problem is both our difficulty in obtaining the proper staff to do this work and the amount of funds available. At the time we go to the Budget Bureau with our annual budget request for survey funds, we give them a list of those surveys upon which we intend to apply these funds, and from that time on through the congressional appropriation committees the money that we have in the budget and later in the appropriation act we consider to be committed, because obviously that information becomes known to the Members of Congress and the people of that area and they are insistent that the money be applied in accordance with the list which we furnish the committees, although legally we do have full authority to transfer from one study to another.

Therefore, we are committed to that program. In selecting that program we endeavor to select those river basins which we think require the study most in order to develop the program.

That, sir, is why we probably have not in the past 2 years tried to obtain money for the survey on the Rogue and the Coquille and the other Oregon rivers you mentioned.

At the present time we do contemplate in our fiscal year 1957 program to be funded out of the current budget under consideration by Congress right now, to undertake some of the surveys which you mention.

Senator MORSE. Let me point out most kindly that last year, for example, the budget recommended by the administration for surveys in Oregon totaled $24,500, but when Congress came to act on the budget on a national basis they increased it for the country as a whole by $1,035,000, and thereafter no additional money was added to Oregon for surveys. Thereafter we had these terrible floods. I don't need to tell you I am asking the Senate why didn't some of this additional money come in to Oregon in view of the Army engineers' undoubted knowledge of the potential danger.

Why cannot we get some of this money specifically allocated to these very dangerous rivers from the standpoint of floods? You don't need to give me the detail today, but I think I ought to have a memorandum

on it. I would just like to know, if the surveys you have testified to are the first step, whether in my State or any other—I don't care. I will fight—I mean it and I think I have proved it by my record—I will fight for flood-control projects in North Carolina or Massachusetts or anywhere else. I just happen to think it is the moral obligation of a representative of Government. That is my theory, and nobody is ever going to change my mind on that. That is what I think a free government should do for a free people. You can't do it by yourself.

I am disturbed, General, that even though Senator Neuberger and I laid this out in a letter to the Army engineers and, I think, did a job of forewarning, we just could not get any funds allocated to survey these rivers, and we haven't yet.

I am presenting in the record today additional information which seems to indicate that we have one of the most serious flood potentials out there of our history. You know some of the reasons for it. I think you ought to get to work. There is a population increase. More deforestation goes on. As man moves in he tends to create flood problems for himself. I am calling this to your attention here this morning because I think we are entitled to have you take a look at it, as every other State is entitled to have you take a look at comparable problems.

I am not going to sit here asking that my State receive an advantage over another State which may have a more serious problem. I haven't any right to do that and I won't do it. But I think we have a pretty bad problem out there. I think you ought to allocate some funds to these rivers and get the surveys going.

If it is because you haven't got the personnel—people reading the record may think it is a little foreign to this hearing, but I don't happen to think so—if it is because you haven't got the personnel, then I think we had better take a look at what we are doing in this country about making available engineering personnel, because I think the evidence we are getting on the Foreign Relations Committee—and I sit here at this hearing only as a representative of the Foreign Relations Committee—is that Russia is running away from us by leaps and bounds in the training of engineers, scientists, and technicians. Our apparent deficiency in this matter is one of the causative reasons why the American people are not receiving better protection through flood control.

Your Corps of Engineers tells me from time to time that one of the reasons you are not spending your money which is already appropriated more rapidly than you are spending it is because you haven't got the personnel and you can't hire them. You just can't go out in the market today and get the engineers that we need put on public works projects to carry out these moral obligations I am talking about.

Am I just talking idle theory here or do you concur in what I have said or to whatever extent you concur, would you make a statement? I think you people in the Army engineers, may I say most respectfully, have a great job of public education to do on this, too, getting the American people to see that we are losing out in the competitive race in the training of scientific personnel. Am I dead wrong about this?

General ITSCHNER. No; I think you are entirely correct. When I testified before the Senate Appropriations Committee for the urgent deficiency bill which was passed just recently to provide funds for the

emergency starting of a flood-control program in New England, I stated that we were having the greatest of difficulty in obtaining engineers who were the least bit qualified to do this work, and further that we were losing the engineers we had at an alarming rate. The primary difficulty, as far as our work is concerned, is that we cannot compete with private industry at this time at Government pay rates.

For instance, I know of one case where the entire student body graduating from this particular institution in engineering was being offered pay of $410 and more per month. The best that we could do in getting those same graduates would be to pay them something on the order of $340 per month. Many years ago it used to be that, even so, we could stand a differential, maybe not of that amount but a substantial differential, because Government employment lent a certain amount of security to their lives, which today does not exist to the same degree because of the fringe benefits which are given by private industry. So we do not have that advantage anymore.

We have had a serious problem because of lack of personnel, the lack of qualified engineers.

A possible solution in some cases is to go to an architect-engineering firm and hire them to do the job. Of course, we would pay them substantially more than it would cost us to do the work. They probably turn right around and hire our own people at a higher rate of pay.

Senator MORSE. Hire them away from you?

General ITSCHNER. Hire them away from us. Then, too, there are certain types of work where that does not present a satisfactory solution. Architect-engineer firms can do an excellent job on the design of a powerhouse, let us say, but we feel that we must have staff personnel to establish the criteria for the design of that powerhouse and develop these projects and to check the architect-engineer's work to make sure that it is satisfactory.

We are in a very difficult period for getting personnel.

We have considered that possibly the Congress might want to enact some sort of legislation which would assist in financing the tuition, at least, of superior students in engineering, scientific, and technical courses. Then require of that student some sort of agreement that he would stay with the Federal Government for, let's say, 4 years after a 4-year course, and permit him to reimburse the Government for the entire amount the Government spent on his education if at any time he wants to break the agreement.

Senator MORSE. I am glad you mentioned that, General, again I say some may think this is far removed from flood-control legislation, but it isn't. There is no sense in having the legislation if you haven't got the personnel to carry it out. Some of us on the Foreign Relations Committee are very much concerned and we are joining in the advocacy of so-called Federal scholarships along the lines that you mentioned, whereby the boy or girl is put through scientific training on the basis of a contractual relationship with the Government whereby he will devote a certain number of years to Government service.

Of course, he is not in uniform. We don't want it to be accused of "creeping socialism." It makes you a dangerous radical if you propose something like that. We will have to come to some such program in order to offset, I think, the totalitarian practices prevailing in the countries with which we are in competition.

My last question, Mr. Chairman, and then I shall at a later time want to recall General Itschner because I have found him in my work in the Senate to be one of the most competent and able witnesses that we have. He has never hesitated at any time. He always gives me honest views and facts. I believe toward the end of this hearing there will be a series of questions I want to ask him. Here again I don't want in any way to involve you in any political problems, so I think I will put it this way: I think I will make a statement of opinion and then you can make any observation on it you want to.

I have been a little concerned the last couple of years as we have been faced with these authorization problems and surveys and appropriation problems, about what has appeared to me to be recommendations from the Army engineers to the Bureau of the Budget which are most inadequate recommendations from the standpoint of what the testimony of the Army engineers shows the need to be. The program falls so far short of the need in problem after problem. I wonder if the Army engineers are not handicapped in advising the Congress by what sometimes appears to me to be an injunction placed upon you by the Bureau of the Budget, which means the administration, that your recommendations cannot go beyond a certain point because of a desire to balance the budget. I happen to be one who believes that you can't talk about balancing the budget in terms of saving lives.

Even materialistically, that is false economy. If we have a moral duty here to provide flood control, as I think we have, then the economic considerations such as balancing the budget on that particular activity I think ought to be ignored.

That is my comment. Now my question is: Is it not true that prior to the beginning of each fiscal year in the preparation of your budget recommendation the Army engineers have to operate in a field beyond which they are instructed they cannot go?

General ITSCHNER. That is substantially correct sir. Prior to the fiscal year 1956 budget request we were permitted to submit a list of projects which we call overceiling in addition to the ceiling, and they were considered by the Bureau of the Budget. Very few of them ultimately ever got into the budget, but they were considered. In the current fiscal year, 1957, we were given a ceiling without being permitted to submit an overceiling amount.

Senator MORSE. That is all, Mr. Chairman.

Senator DWORSHAK. One question at this point: Is it not true, General, that your overceiling requests have always been submitted to the Appropriations Subcommittee which handles your budget so the members of that committee have an opportunity to know what your overall planning is?

General ITSCHNER. That is correct, sir. They generally ask what our overceiling amount was, and they even go beyond that. Almost always they ask us, "How much did you ask for?" "How much would you have asked for if you had a free hand?"

Senator DWORSHAK. That puts the responsibility then upon the Congress to consider all of your projects, even those beyond the so-called ceiling?

General ITSCHNER. Congress certainly has an opportunity to consider all the projects.

Senator NEUBERGER. We are just about at noon, when I said we would recess until 2.

General, I have some questions on Canada that I would like to ask you this afternoon. Would it be too much inconvenience for you to be back at approximately 2 o'clock?

General ITSCHNER. I would be very happy to be here at 2 o'clock.

Senator NEUBERGER. We certainly thank you for your very cooperative way of answering question and your very comprehensive testimony.

We are in recess until 2 o'clock this afternoon.

(Whereupon, at 11:55 a. m. the committee recessed, to reconvene at 2 p. m. the same day.)

AFTERNOON SESSION

Senator NEUBERGER. The committee will come to order.

STATEMENT OF MAJ. GEN. EMERSON C. ITSCHNER, ASSISTANT CHIEF OF ENGINEERS FOR CIVIL WORKS; ACCOMPANIED BY MAJ. FELIX R. GARRETT, ASSISTANT CHIEF OF CIVIL WORKS FOR POWER; CHARLES W. KINNEY, CHIEF, POLICY BRANCH, PLANNING DIVISION, CIVIL WORKS; AND GORDON H. FERNALD, CHIEF OF PLANNING BRANCH, NORTH PACIFIC DIVISION, PORTLAND, OREG.—Resumed

Senator NEUBERGER. To go back to right after you presented your very informative testimony to us, in answer to a question of mine, you said that if there were no international border, your own feeling would be that the projects to be built in sequence would be first, Libby Dam, and second, Mica Creek Dam; is that right?

General ITSCHNER. That is correct. But you recall, I said it would take some study before we could be sure of that. That was just my offhand opinion.

Senator NEUBERGER. This is what I wanted to ask you. What would be the effect on those two proposed projects if this Canadian diversion, as suggested on the floor of Parliament, and now being studied, were to be put into actual development and construction?

General ITSCHNER. If the diversion occurred from the Kootenay in Canada, into the Columbia at Canal Flats, the Libby project still would be economically justified, but, of course, it would not be as good a project as it would be if the diversion did not occur.

If the diversion occurred at the Bull River site, which is a site on the Kootenay River downstream from Canal Flats, the Libby project would not be economically justified. If any diversions occurred from the Columbia Basin into the Fraser in Canada, of course, they would be extremely harmful to the projects we have in place now, or contemplate constructing downstream in the United States.

It depends largely upon to what extent the diversion would occur; what their plans of operation would be.

Senator NEUBERGER. Most of the proposals I have seen would be something like 14 million to 16 million acre-feet. Does that coincide with what you have in mind?

General ITSCHNER. Yes, I have heard General McNaughton and some of the Canadians mention the figure of 15 million acre-feet.

Senator NEUBERGER. Would it still be possible, if 15 million acre-feet were diverted, to operate the existing projects in the United States efficiently, and at their present production?

General ITSCHNER. I haven't studied that possibility, and it, of course, is one of the many things that we are now engaged in studying in our present survey report, so I really don't know the answer to it.

There, again, I believe it would depend entirely upon at what time of the year the flow was captured in the amount of 15 million acre-feet.

Senator NEUBERGER. You, yourself, have not evaluated the feasibility of the two Canadian diversions at all, have you?

General ITSCHNER. No; we have not. We have been waiting to find out from the Canadians what they propose to do.

Senator NEUBERGER. Again, I want to come back to these diversions because I do believe that the opinions of the Engineer Corps are very important as they bear on what the Canadians do.

If the diversion took place, 14 or 15 million acre-feet, would that prevent additional projects which are now contemplated on the Columbia?

General ITSCHNER. This is just an offhand opinion because it has not been studied, but I would say that it would not prevent additional projects on the Columbia River. I would doubt that very much. I think that it might very likely prevent the full development of the planned projects and those projects already constructed.

In other words, the ultimate development might be curtailed by diversion.

Senator NEUBERGER. I want to go back to one of the things which we discussed this morning a little bit. I don't want to presume on the time of other Senators, and that is the reason I didn't follow it up.

It is the thing that bothered me a great deal when I was up in Canada for about 2 weeks talking to Canadians in public and private life about the diversion. I gathered the opinion that statements made in the International Joint Commission minimizing the value of Canadian storage to the United States had played a very important part in the enactment by Parliament of the appropriation to study the diversion.

I think I am right, am I not, in saying that this is the first time the proposed diversion had ever been the subject of extended parliamentary debate in Ottawa, and been the focal point of an appropriation passed by Parliament?

I gathered, talking to members of Parliament of quite a wide section of political affiliation in Canada, that the statements made in the IJC, as I say, minimized the value of Canadian storage on the presumption that Canadian storage would come very late in the sequence; that is, after a whole group of other projects had been built in the United States.

You, yourself, said earlier this morning that it was true that the value of storage lessened as the project came further on chronologically in a whole succession of other developments on the same river system, but, General, in your opinion, isn't it quite dangerous and not entirely justified to say to our Canadian neighbors, as in effect has been said, "Your storage may not be very important to us because we are going to have all these other projects built in our own country," if you see what I mean.

Doesn't that encourage them to divert? That is the thing I found in Canada which has so worried me, for this reason: Obviously, if the Canadians think that the storage is of a minimum value to us, and therefore, the likelihood of downstream benefits being compensated for, then they have very little alternative, perhaps, except to divert.

Isn't it rather foolish for our people who are negotiating to presume that we are going to have all these projects in the United States which will minimize the value of the Canadian storage?

General ITSCHNER. Senator, I think in any consideration of the problem of Canadian storage, we must consider the time element and that very likely there will be projects built from time to time having storage in the United States.

The existence of these alternative United States storage projects, of course, will affect the value of the Canadian storage. In order to try to arrive at any value for Canadian storage at this time, it would be necessary to know what the plans are for the future.

Personally, I can't see how anybody is ever going to enter into any such consideration with any assurance, because we do not know what storage is going to become available in the United States. Consequently, perhaps the best solution would be to find some sliding scale as to the value of Canadian storage depending upon the amount of storage in the United States, depending upon the load on the entire system, and depending on the amount of thermal-generated power incorporated into the system.

I think it is premature at this time to try to estimate the value of Canadian storage.

In answer to one other remark that you made, I was not aware that any real consideration has been given on an international basis to the value of Canadian storage. I don't think it has come up yet in the International Joint Commission.

It may have been mentioned just offhand, but there have been no studies on that subject completed to date.

The Columbia River Engineering Board, which is the agency of the International Joint Commission which is responsible for making such studies, has such studies on the agenda, but they have not been completed. In fact there has been very little done on them so far.

I might read to you the list of the appendixes to the Columbia River Report which will be made by the Columbia River Engineering Board. The first appendix is the Columbia River and Canada. The second is the Kootenai. The third appendix is the Clark Fork of the Pend d'Oreille. The fourth appendix is the Okanogan-Similkameen, which has been completed. It is the only one which has.

The fifth one, minor international tributaries, such as the Moyie, Yaak, Kettle, Flathead, and so on. The sixth appendix is the main stem of the Columbia River and tributaries in the United States. The seventh appendix is entitled "Economic Studies." That appendix will include economic principles, power, flood control, irrigation, navigation, and other economic studies.

Senator NEUBERGER. I am glad to get that, and I am glad to have it part of the record. This is what I was referring to when I asked you about the presumption already made.

I am not asking you to comment on agree or disagree on anything Governor Jordan said, but I just want to read to you 1 or 2 para-

graphs of his statement to the Pacific Northwest Trade Association in Vancouver, British Columbia, on May 10, 1955.

This statement, it seems to me, tends somewhat to refute your statement that as yet there has been no value placed on the Canadian storage. Let me just read a few of these paragraphs. I won't read the whole thing because it is very long, but I am going to read some representative comments.

Moreover, the values of headwater storage are not only difficult to determine at a given time in a given system, but these initial values regress very rapidly as additional storage is added to the system. * * *

"Claims have been made that the Mica Creek project, for example, would increase prime power output in the United States by approximately 1,100,000 kilowatts plus hundreds of thousands more when the John Day, Priest Rapids, Wells, and Rocky Reach projects are built. The conditions and assumptions which are necessary to support such a figure are unrealistic and it is a gross overstatement of the true value of the project to the United States. * * *

Then Governor Jordan has a long comment about assuming other projects will be built. For example, he says:

Another factor of even greater importance is the assumption as to the order in which various storage projects will be developed.

He cites the possibility that all these other projects will be built, and goes into detail about them. Then, let me read his concluding paragraph, and particularly his concluding sentence, because I think this has had a profound impact in Canada, and certainly is a part of the whole diversion picture. I will read the whole paragraph and then emphasize the final sentence.

Moreover, as we go beyond the degree of hydroelectric power development which I have described, we expect to enter a phase D level of a hydrothermal system. This may be based upon thermal plants using coal, oil, or gas (the fossil fuels) or may be based upon nuclear energy. In either event, most of the hydroplants will at that time increase their installations to the maximum practicable to operate for peaking purposes, as they do already in most parts of the United States.

Although we have not yet fully studied such a system, it is apparent that downstream benefits of storage will have to be evaluated on a completely different basis than for an all-hydro system. At that time, the main stem Columbia River plants will easily be able to maintain their presently planned ultimate installations as dependable capacity, without any increase in regulation of the river by storage in Canada.

Then he concludes with this sentence:

Storage projects in Canada will no longer afford a large advantage to the United States.

That is what was said to the Canadians right at the height of the debate in Parliament over the diversion. It seems to me that this (1) encourages the diversion, and (2) makes certain assumptions which are not too safe; that we are going to have all these additional plants in the United States which will reduce the value of Canadian storage.

Am I right or wrong about that?

General ITSCHNER. Let me say this, Mr. Chairman, if I may. The value of Canadian storage can only be determined after a long series of studies and conferences, and, finally, agreements between the Canadians and the United States, because both parties are involved in determining the value of Canadian storage.

Those studies have not been made. The agency established to work out these details is the International Joint Commission. They, in turn, have referred this matter to the Columbia River Engineering Board, who have it under consideration and under study at this time.

There are certain principles which must first be determined before a value can be derived for Canadian storage. We must know how much of the benefits at the downstream sites are to be attributed to the storage in Canada and how much to the head.

A simple thing like that has not yet been determined. There are many other more complicated problems in determining the value of storage from upstream plants, whether in Canada or not.

I think it is a matter for study by agencies established for that purpose, and, obviously, they must include Canadians. I think it is something that we cannot look for a solution to for some time. It is just too complicated a problem.

Senator NEUBERGER. You see, I would go along with everything you said. I agree with your answer. The thing I am disturbed about is that certain assumptions have already been made by the American Chairman of the IJC in this statement. That is the thing I am concerned about, when, as I say, he made a very long statement in Canada which tended to minimize the value of Canadian storage.

I think your position is exactly the right one, that it should be evaluated and studied from the engineering standpoint, from the existing political and controversial situation involving each site in the United States, what may or may not have happened to Hells Canyon, what is going to happen at Bruces Eddy, and all these others.

The thing I have been disturbed about is the statement made in Canada to the Canadians at the height of the controversy which concludes by saying "Storage projects in Canada will no longer afford a large advantage to the United States." It seems to me that already a judgment had been made and that conclusion reached.

I think your approach is the right one, but I didn't think that was done in what the IJC said. I am not going to ask you to comment on that because it wouldn't be fair to you, but I want to ask this question.

Who actually makes the policy judgments on which these assumptions of future United States development are based? Who makes such a policy judgment? Do the engineers participate in this? Is it the IJC alone? Is the State Department in on it? Who makes such a policy judgment as expressed in this statement which I have read in part?

Do you know?

General ITSCHNER. I know that in any consideration of problems like this by the Columbia River Engineering Board or its committee, the representatives of the two nations would get together and try to agree upon a premise for the determination of the values of Canadian storage. The board would then report its conclusions and recommendations to its parent organization, the IJC, who would make the policy decisions.

Senator NEUBERGER. Were you consulted prior to this statement at Vancouver?

General ITCHNER. No, sir; I don't think so. We have frequent conversations with the IJC, but I had nothing to do with that particular statement, of course.

Senator NEUBERGER. You had nothing to do with that statement. I would like to ask, did Mr. Fernald, who has worked so closely in the area? Was he consulted?

Mr. FERNALD. No, sir. I think I read it in your report for the first time.

Senator NEUBERGER. You were not consulted prior to this statement which was made at Vancouver. You see, what I am trying to get at is, is there a plan actually agreed upon in any agency or anywhere that you know of for future projects, the likely sequence in which they will be built, and then given to the IJC as the basis for their representations to the Canadians?

General ITSCHNER. When the Corps finishes the review survey which is now in process, that study would, of course, be made available to the IJC. It is just in progress at this time.

The IJC has no official information as to what is going to be incorporated in that study. As a matter of fact, we here in Washington know very little about the details at this time.

Senator NEUBERGER. That is all the questions I have at this moment, General.

Mr. Mapes, do you have a few questions?

Mr. MILTON C. MAPES. I have a couple which were raised by your statement, General. You say on page 3 of your statement that the earlier storage sites are not now available.

If they were available, would they be important to your main control plan today?

General ITSCHNER. Yes; they would, unless a substitute has been found for any one which precludes the construction at the original site.

Mr. MAPES. Were not most of the proposed substitutes actually included in the original 308 report for later construction?

General ITSCHNER. What I was referring to was a substitute for Hells Canyon in the form of two other reservoirs, perhaps in the same reach of the river, which, of course, are not full substitutes in storage, but they do give a partial substitute.

Mr. MAPES. Can you tell us from your memory—I realize this is a bit difficult—when the last storage project in the basin was commenced? Do you know that?

General ITSCHNER. It was probably Palisades; wasn't it?

I can easily have that information obtained and inserted in the record. It was some time ago, I would say.

Mr. MAPES. Was it before 1950? It must have been.

Mr. FERNALD. I don't know when Palisades was started.

Mr. MAPES. We have a Bureau witness here. Perhaps we could ask him. Is there someone here from the Bureau of Reclamation?

Mr. DANIEL V. MCCARTHY (Chief, Program and Coordination Branch, Division of Project Development, Bureau of Reclamation). I am sorry; I didn't hear the question.

Mr. MAPES. The question was, When was Palisades commenced?

Mr. MCCARTHY. When was construction commenced?

Mr. MAPES. Yes.

Mr. MCCARTHY. About 2 or 3 years ago.

General ITSCHNER. Was that later than Hungry Horse?

Mr. McCarthy. Yes. It was authorized in 1950, I believe. Construction wasn't started until 2 or 3 years ago.

Mr. Mapes. General, you also mentioned the value of Grand Coulee, with alterations. Have you made estimates of the cost of such alterations?

General Itschner. No, we have not because there, again, it is a Bureau of Reclamation project and problem. I am sure they have made preliminary studies on it. I am not sure whether they have an answer to the problem or not.

We know what needs to be done, and it is difficult and expensive.

Mr. Mapes. But to your knowledge, the appropriations for that have not been requested?

General Itschner. I don't know whether they have been requested. I know they have not been made.

Mr. Mapes. You spoke of the present outlook of reducing the floods of 1894 to 920,000 second-feet. Is that correct?

General Itschner. That is right, 920,000 second-feet.

Mr. Mapes. Perhaps I could read one section on page 103 of volume 1 of the 308 report.

> Provision of the desired degree of protection by levees alone is impractical due to engineering economic considerations. The foundations in many instances are inadequate to withstand the pressures from levees of the height necessary to protect against the uncontrolled flows.

Then below, a little further down, the statement:

> The upper limit of 800,000 second-feet for the controlled flow has been established after considering the flood stages that the present and future levee systems could safely withstand.

Is it still the feeling of the corps that that is the maximum that can safely be leveed?

General Itschner. That is something that we are on doubt about, partly because of the improved techniques in the construction of levees. In the last few years, we have gone in some instances to a system of relief wells on the landward sides of these levees from which we pump water in times of extremely high floods, thus relieving the pressure effect on the levees, thereby making them more secure.

So I am not at all sure that levees might not be constructed in the lower Columbia Basin to withstand a flood greater than that represented by a flood of 800,000 second-feet at The Dalles.

That is something that we are studying in this new study. It was specifically stated in the directive that they would study the possibility of improving these levees.

The other question involved, of course, is the cost of improving those levees, and it would be substantial. So we would have to balance that cost against the cost of providing an equally effective amount of additional storage.

Mr. Mapes. Have there been any substantial changes in the levees since 1948?

General Itschner. Very few changes in the levees. There are a few that have been made by local interests. I believe none by the Federal Government since that time.

Mr. Mapes. I have a question which concerns the calculation of values from these storage projects in the future. Didn't the interagency study group use the allocation method in determining the future value of those projects?

General ITSCHNER. Yes; we did. The interagency group did use a standard method of allocating costs. It is the normal method we use in all our cost allocations.

Mr. MAPES. Does that consider the future construction taken as a whole to have been accomplished, and then allocate value of one of those projects?

Perhaps I should clarify it. In other words, Mica Creek has a certain value if constructed today. If constructed after some other project, it has much less value.

General ITSCHNER. Yes.

Mr. MAPES. My question is directed to determine if this method is used on every project which is considered, does it not act as a control on the feasibility of those projects so that it might impede even the attainment of the first project?

General ITSCHNER. The study was made on several different bases, considering that other storage projects were built at various times. In other words, various combinations of storage projects in the United States.

Mr. MAPES. To move on to another subject, you mentioned the total potential of the basin. Can you tell how that relates to the peaking and average figures given on page 10 of your statement, the estimate for the total potential, and also the average for peaking?

What is the relationship there? Can you tell us?

General ITSCHNER. How we derived the average amount as compared to the peaking amount?

Mr. MAPES. Is the total really a theoretical value of the total amount of water multiplied by the head?

General ITSCHNER. Yes. It is determined by the volume of water and the head through which it falls.

Mr. MAPES. These other figures, average and peaking, are what you think may be obtainable?

General ITSCHNER. That is correct, in an average year.

Mr. MAPES. Are there any joint studies currently underway with the Canadians on these problems, to your knowledge?

General ITSCHNER. Yes; there is a joint study underway, the study of the Columbia River Engineering Board, which I mentioned. The Columbia River Engineering Committee, which is the working group for the Columbia River Engineering Board, is studying this problem.

I gave you a little while ago the different appendixes to the report which they plan to accomplish.

Mr. MAPES. One other question. You mentioned, on page 12 of your statement, I believe, the possibility of obtaining these reports as the basis for final negotiations with Canada. Would you recommend that a separate treaty be negotiated with Canada for the purpose of settling the problems in the Columbia Basin?

Do you think that would be of value in this problem?

General ITSCHNER. I don't think a separate treaty would be necessary in all probability. I think that is something which has to be determined after the Canadian-American discussions are had.

At that time it may be necessary to have a separate treaty, but I don't see why it should be.

Senator NEUBERGER. General, may I ask just one thing before you go?

I asked your opinion about which projects you thought would be most valuable if there were no boundary, and you gave purely as your opinion Libby first and Mica Creek second.

Don't you think if that proves to be correct, that we ought to make every single possible effort to work out some sort of agreement with the Canadians, even to the point of allowing them to share in certain downstream benefits in order to facilitate those projects?

General ITSCHNER. Yes; I think definitely we should make an agreement, if possible, with Canada, and the agreement should be equitable to both sides of the border.

Undoubtedly there is some necessity for giving to Canada a share of the benefits which will be derived downstream.

Senator NEUBERGER. Speaking of downstream benefits, I found when I was in Canada there is great opposition on the part of Canadians to receiving any of the downstream benefits in the form of monetary cash payment. They felt they didn't need money, but they needed power.

Also, I find people in British Columbia taking the viewpoint that the cash would be paid to Ottawa, whereas the power would be used in British Columbia, which you can understand, because the storage which would make possible the power would be contained in British Columbia.

If there should be an agreement for downstream benefits, how do you feel as to whether it should be in monetary payments or in a certain sharing of the power?

General ITSCHNER. I should think that the most equitable solution would be to give Canada a share of the additional power produced, for several reasons, the most important being that money has a habit of becoming worthless as years go by, and electricity probably will be of enduring value.

It represents a commodity to them which will be worth just so much throughout the years. I do feel—and this is entirely a personal feeling—that any solution worked out with Canada should be on a sliding basis, so we do not try to predict what storage is going to be in existence in the United States 5, 10, or 20 years from now, and we do not try to predict how much thermal-generated power will be in the system, but, instead, we evaluate the worth of that Canadian storage each time there is a change in the situation.

If we could do that, I think we could get an equitable solution. Otherwise, it will be highly speculative, and probably neither side is going to be satisfied.

Senator NEUBERGER. You mean by that, for example, that whenever we would bring in a new reservoir, or a new steam plant, perhaps our contribution to Canada would go down?

General ITSCHNER. Exactly that.

Senator NEUBERGER. Or if perhaps they added a new reservoir up one of their rivers, whatever it might be, the Canoe or the Wood, or anything else, perhaps our contribution would go up?

General ITSCHNER. That is what I had in mind.

Senator NEUBERGER. But, in any case, it might be in terms of power rather than money.

General ITSCHNER. I think that is more equitable for both sides.

Senator NEUBERGER. I certainly agree with that. I notice that while we were talking Senator Dworshak returned to the committee room.

A great many of these projects in the United States are in his State, and he might want to ask you some questions.

Senator DWORSHAK. Just very briefly, Mr. Chairman; thank you.

At the morning session, General, reference was made to the potential flood threat in the Columbia River Basin this spring. That is more threatening than we have had in recent years?

General ITSCHNER. It is more threatening than we have had for many years, Senator. Of course, so much depends upon the weather between now and then, as you know. We must not become alarmed, but we must be prepared at least for what might be a very serious flood.

The chances are almost certain that we will have a flood. The question is whether it will be a minor one with relatively small damages, or a very great one.

Senator DWORSHAK. Are menacing conditions found on all three of the important watersheds, the Snake, the Salmon, and the Clearwater, in the upper basin, or does one have greater potentialities as far as floods are concerned?

General ITSCHNER. I think it is true throughout the entire Pacific Northwest that they have very heavy snowpak.

Senator DWORSHAK. This morning you indicated that you would be very much interested in expanding the planning for flood-control projects and reservoirs in the upper Columbia River Basin, and I pointed out that the Appropriations Subcommittee which handles your budget, of which I happen to be a member, has had a opportunity to increase the budget requests for such funds.

I want to commend the Army Engineer Corps for doing a very effective job in the Columbia River Basin. As Senator Morse pointed out this morning, undoubtedly it is not exclusively a matter of having available funds with which to make these surveys, but probably just as important, the lack of trained personnel with which to undertake these surveys.

That is true, isn't it?

General ITSCHNER. Yes, sir; it has been both the matter of funds and the lack of trained personnel, and our inability particularly to get additional personnel to supplement our efforts.

Senator DWORSHAK. Naturally, coming from the Columbia River Basin, as Senator Neuberger and Senator Morse do, I have been very much interested in the current developments in the basin. I wonder if we have not had even greater consideration and larger appropriations in that area than have been available to many other important river basins throughout the United States?

General ITSCHNER. Yes, undoubtedly the Columbia Basin in recent years—by that I mean since about 1948 or thereabouts—has received a very large share of the total amount of appropriation for river and harbor development.

Senator DWORSHAK. Is that for construction or also for planning and surveys?

General ITSCHNER. That has been for both construction and for planning, although obviously most of the funds have been for construction. In fact, it has run as high as about 30 percent of the entire appropriation in some years.

Senator DWORSHAK. Thirty percent of the entire appropriation given to the Army Engineer Corps has been expended in the Columbia Basin for construction and planning?

General ITSCHNER. Thirty percent for construction of river-and-harbor and flood-control projects has gone to the Pacific Northwest.

Senator DWORSHAK. What percentage of the engineering funds, survey funds? Do you have that figure available?

General ITSCHNER. I don't have that figure available, sir. It has no been in that high a percentage. It would be something considerably less than that.

Senator DWORSHAK. Would it be possible for you to give an offhand figure, telling us the total amount of money which has been expended in the Columbia River Basin for construction, say, in the last decade?

General ITSCHNER. I can get that for you and insert it in the record very quickly. I can't give it to you know. That would be hard to do. It has been very great, relatively, in the Columbia Basin.

(The matter referred to is as follows:)

Funds expended in the Columbia River Basin for construction and advance planning from appropriations to the Corps of Engineers for fiscal years 1936 through 1955 total $789,554,550, not including miscellaneous allotments from general emergency relief appropriations. In addition, construction and planning funds totaling $99,395,000 were allotted for work in the Columbia River Basin during fiscal year 1956; however, only about 60 percent of these funds have actually been expended to date.

Senator DWORSHAK. It may be if there has been an inadequacy of funds with which to make these surveys in the Columbia River Basin, and especially in the upper basin tributaries, it isn't because there has been any tendency to ignore the Columbia River Basin, but rather, that regardless of how much work is done, you probably reach the point where you had completed the essential planning work of providing all of the flood-control reservoirs to eliminate future floods and to provide maximum use of the waters of the tributaries of the Columbia River.

General ITSCHNER. I think that is a true statement.

Senator DWORSHAK. I think that is all.

Senator NEUBERGER. I want to ask one question along the line of Senator Dworshak's questioning, General.

About what proportion of the available hydroelectric power in the United States is in the Columbia River Basin?

General ITSCHNER. It has been estimated that 40 percent of the potential hydroelectric power in the United States is in the Columbia Basin. As I indicated earlier, not all of that amount is economically feasible and can be developed.

Senator NEUBERGER. General, after you leave the stand, I wonder if we could ask Mr. Fernald a few questions? Before you leave, I want to thank you very much for the cooperative way you always answer questions and give us information, both here in the committee meetings and in writing and orally from your office, and I am certainly very grateful for your being here today and bringing us all the very useful data and material which you have.

General ITSCHNER. May I add just one statement, sir, in answer to a question which you asked earlier. That is in connection with the statement I made in response to your question about the speech made by Governor Jordan Vancouver.

I think I should supplement that answer by saying that the corps did have some discussions with Governor Jordan about this interagency study which was made sometime before that speech. During these discussions, it was brought up a number of times that the value of Canadian storage decreased as storage was obtained in the United States, and also as steam went on the line in the United States.

Senator NEUBERGER. But did the corps set down any proposed or possible schedule or sequence by which these projects would be built which would, in effect, justify the statement that the value of Canadian storage might go down very sharply?

General ITSCHNER. This interagency study made some assumptions as to the sequence of projects in the United States which might lead to that conclusion, but they were labeled clearly as assumptions and several different assumptions were made, so there was a basis for all the conclusions given in those interagency reports.

Senator DWORSHAK. Mr. Chairman, I would like to clarify the answer the general gave about 40 percent of the Nation's potential hydroelectric power being available in the Columbia River Basin.

What percentage of that has already been utilized? That is the overall potential; 40 percent.

General ITSCHNER. That is correct, sir.

Senator DWORSHAK. Has half the potential been developed?

General ITSCHNER. No, sir; not half.

Mr. FERNALD. About 7 million out of 35 million.

Senator DWORSHAK. About one-fifth, then. Does that include both public and private?

General ITSCHNER. Yes.

Senator DWORSHAK. Can you break down the 7 million as between private and public?

Mr. FERNALD. Yes, sir; I believe I can.

Senator DWORSHAK. I don't want to delay you.

Senator NEUBERGER. It is important information, I think.

General ITSCHNER. We can figure it out very quickly by doing some adding.

Mr. FERNALD. There are about 7 million kilowatts in the Pacific Northwest power pool.

Senator DWORSHAK. That is all private power?

General ITSCHNER. Nameplate ratings, installed capacity.

Mr. FERNALD. Of that, 51 percent is Federal, 3,589,000 kilowatts of Federal; the balance is private.

Senator DWORSHAK. Forty-nine percent is non-Federal?

Mr. FERNALD. That is of the power pool. There is about another 7 million kilowatts of nameplate ratings which are PUD developments and other developments in and adjacent to the power pool area which are not included in that.

Senator DWORSHAK. They are in the Columbia River Basin?

Mr. FERNALD. Not entirely.

Senator DWORSHAK. I thought the power pool included everything in the Columbia River Basin.

Mr. FERNALD. That takes care of all the major ones.

Senator DWORSHAK. Both private and public?

Mr. FERNALD. Yes, sir.

Senator NEUBERGER. Any other questions, Senator Dworshak?

Thank you very much.

Mr. MAPES. I have just one more question, General. You mentioned the need to reallocate the downstream benefits with the system changing. Doesn't this raise particular problems on the estimation of the feasibility of a project which is about to be undertaken, for instance?

General ITSCHNER. Yes. We must always consider the future system in trying to evaluate the worth of a project at any one time. In other words, a project could very readily be economically justified if it were to go on the line next, to be the next one constructed; whereas, it may soon drop out to where it is not economically feasible if other projects are built.

That must be considered, and is considered. That is why we have these different phases that Senator Neuberger mentioned, like phase C and phase D systems. They must be considered in that light.

Senator NEUBERGER. Thank you very much, General.

May we ask Mr. Fernald a few questions, if we might?

STATEMENT OF GORDON H. FERNALD, CHIEF, PLANNING BRANCH, NORTH PACIFIC DIVISION, CORPS OF ENGINEERS, PORTLAND, OREG.

Senator NEUBERGER. Would you give your name and position for the purpose of the record, Mr. Fernald?

Mr. FERNALD. My name is Gordon H. Fernald. I am Chief of the Planning Branch for the North Pacific Division of the Corps of Engineers, Portland.

Senator NEUBERGER. Do you wish to ask a few questions, Mr. Mapes, and then Senator Dworshak and I will follow?

Mr. MAPES. I want to ask a little bit about the interagency study. Were you a member of the interagency study group?

Mr. FERNALD. No, sir; I was not.

Mr. MAPES. Did you work on that at all?

Mr. FERNALD. No, sir. That was under the direction of Mr. Nelson, who is in charge of the Water Control Branch in the Portland division office.

Mr. MAPES. Can you tell us in a general statement what the conclusions of that study were as to the downstream effects from the upstream projects in Canada?

Mr. FERNALD. Not in particular, Mr. Mapes. As General Itschner stated, a number of assumptions were made in that study as to the sequences of development, comparing the value of Mica Creek added to the existing system singly and in conjunction with Arrow Lakes, and also in conjunction with Libby and in conjunction with other projects to determine the long-range value and the value of the individual storage under different sets of circumstances.

The general results show that the value of any storage would decrease with time.

Mr. MAPES. If a group of projects is being considered and one of them is uncertain because of particular difficulties such as we are having right now with Libby, is it proper from the engineering standpoint to consider the group taken as a whole estimating the future feasibility?

Mr. FERNALD. That is correct. We have considered in the Corps of Engineers in the past, particularly in the Columbia River Basin,

that the project to be recommended today must retain its economic feasibility over the entire period of economic life. As a part of that economic analysis we have considered what the overall picture would be through that 50-year period of economic life and developed in essence a planned program and evaluated each unit of that planned program. In other words, it is a system analysis as against the incremental analysis, in view of the fact that it is not possible from the engineer's point of view, at the time of survey at least, to evaluate a project on the basis of an incremental analysis because we don't know which project is coming first and which one is coming last. It is only fair to say, as in a chain, each link or unit is necessary to complete the overall result, it is not fair then to give the first project all the credit and the last project no credit, where you might end up with an incomplete system, because frequently the last project would not be justified by the small residual, and yet it is as important as the first one.

Mr. MAPES. In making that study do you know whether or not the year-by-year costs and benefits were computed with the addition of steam values over the future years?

Mr. FERNALD. No, sir. I believe some spot values were considered in the course of the study, but I don't believe any effort was made to evaluate in dollars and cents the storage or the power in any of those interagency studies. It was confined entirely to kilowatts.

Mr. MAPES. On the basis of your experience and training, Mr. Fernald, if you had full control of developing the Columbia or planning its development, would you include large storage projects in that development now?

Mr. FERNALD. I believe, Mr. Mapes, that the Columbia River at the present time is in need of some additional storage, primarily from the standpoint of flood control.

We are deficient in our flood-control storage, and that would appear to me, as is General Itschner's stated view, that storage would be the important element at the present time, particularly with reference to flood control and power needs, rather than additional run-of-river projects.

Mr. MAPES. Can you give us a fairly brief summary of your concept of the use of hydro in the development of the Columbia River system with the increasing use of thermal or atomic energy?

Mr. FERNALD. That is rather a large order.

Mr. MAPES. Yes, I realize that.

Mr. FERNALD. We might approach it this way: The Columbia River system at the present time is strictly a hydro system, although there is a small amount of existing steam. Consequently, the hydro projects are operated to take care of both the base loads, that is, the 100-percent load-factor loads, as well as the peak loads. Eventually we will reach, I anticipate, a system of the hydrothermal nature that we have in other parts of the country but we cannot go to that extreme at one jump.

The hydrothermal systems of other parts of the country usually call on the thermal power for the base load and use the hydro for its peaking, which you see is exactly the opposite from what we have now in the Columbia River. I believe we will find over the future that the hydro system of Columbia will gradually take the form of the hydrothermal system of the East, and we will find our hydro projects

participating more exclusively in the peaks than in the base loads. That is a long-range picture, though. It may be in the year 2000 before that takes place.

Mr. MAPES. I had in mind it is difficult to judge how it would develop in the interim period. Assuming hydro were being used primarily for peaking at that point, would the peaking be a daily peaking or a monthly peaking? What would the period of peaking be?

Mr. FERNALD. Of course it could be a daily peaking, in other words, carry what they call the swing, which is a peaking operation of a few hours, 6 o'clock in the morning, 6 o'clock at night, our two peak periods. The lower river navigation, for example, and possibly the development along most of the major tributaries will be such that there is some question as to whether hydro plants will be able to carry swings of that nature.

For example, as General Itschner stated, navigation would be very difficult or practically impossible were the hydro plants of the Dalles, John Day, and McNary to be put on swings like that running from nearly zero output to maximum output in the matter of a few hours. That would be intolerable to navigation. It would be intolerable to the passage of fish. It would be intolerable to any development on the banks of that major river. It may, however, be possible on some of the tributary streams.

Mr. MAPES. Would this in any way decrease the value of your annual and cyclical upstream storage?

Mr. FERNALD. No; that would tend to continue the higher value of the storage for a longer period.

Senator NEUBERGER. Have you yourself consulted with the IJC on the Canadian negotiations, Mr. Fernald?

Mr. FERNALD. Not with the IJC. I have been functioning as an alternate on the working group which is working at the very lowest level, for the Engineering Committee.

Senator NEUBERGER. I want to ask you about another aspect of the Canadian situation. You know I am one of the Senators from a State which has a large commercial fishing industry, as does the State of Washington. It is a subject of great controversy and apprehension about the fate of the commercial fish runs in the Columbia River system and the sport fish runs, too, as you well know. Isn't one of the major arguments to utilize Canadian storage to the maximum the fact that the upper Columbia has already, in effect, been eliminated as an area where migratory fish are any factor?

Mr. FERNALD. Certainly the fish people, at least the commercial fishermen, have never objected to projects located above Grand Coulee. However, there is a resident fish problem in the upper river areas in the United States. The cutthroat trout, for example, in the upper Clark Fork, present storage problems in those tributaries comparable to what we have in the lower river. I am not familiar with the Canadian situation. They probably have resident fish problems as well.

Senator NEUBERGER. There is no commercial fish problem at all in the upper Columbia, is there, such as there would be involving the Salmon River in Senator Dworshak's State?

Mr. FERNALD. No, sir; that is correct. There is a small commercial fishery in the Pend Oreille Lake area. I doubt very much if you would class any of the other fisheries in that region as commercial class. They are all sports people.

Senator NEUBERGER. Has your group taken any stand at all on the proposal of the Puget Sound Utility Council to participate in the building of Mica Creek or on the Kaiser Aluminum Co. proposal to build that storage dam at lower Arrow Lake?

Mr. FERNALD. No, sir; our office has not taken any position on either of those proposals except as resulted in this interagency study which Mr. Mapes referred to. We have taken the position that we should wait until we have our studies completed in this current investigation before any firm position is taken.

Senator NEUBERGER. This is merely a matter of opinion, so I am not trying to embarrass you by this question. General Itschner gave it merely as a matter of opinion. Would you generally share his opinion that, just forgetting the existence of the boundary and any international complications, if you were to pick out the most desirable projects to undertake next in the Columbia Basin, would you list Libby first and Mica Creek second?

Mr. FERNALD. I would certainly list Libby first and probably Mica Creek second; yes, sir. That would be more or less a preliminary opinion based on general knowledge of the two projects. We have made no study, however, of the Mica Creek project.

Senator NEUBERGER. Both of those involve negotiations with the Canadians; do they not?

Mr. FERNALD. Yes.

Senator NEUBERGER. Libby as well as Mica Creek.

Mr. FERNALD. Yes, sir.

Senator NEUBERGER. Is it your opinion if the diversion is undertaken by the Canadians—the diversion into the Fraser River system is the one I have reference to—that would have quite a serious impact on our existing plants?

Mr. FERNALD. That would have a material impact on all of our downstream plants; yes, sir.

Senator NEUBERGER. How would it affect them?

Mr. FERNALD. It would reduce the power capabilities of those projects in the critical power period from September to April since they would no doubt divert during that period from Columbia flows.

Senator NEUBERGER. How much effect would it have, just as an estimate, on the output of a project like McNary or Grand Coulee?

Mr. FERNALD. I could not give you a figure on that. I am sorry.

Senator NEUBERGER. Would it be material or slight?

Mr. FERNALD. I would imagine it would be material in the ultimate because the amount of water that we get from the upper Columbia River is appreciable. At the present time, however, a limited diversion, say, of about 8 or 10 million acre-feet would probably have little effect, but eventually all of that water would be necessary for our own generation and then it would have a material effect.

Senator NEUBERGER. What proportion of the flow of the Columbia originates in Canada; about a third?

Mr. FERNALD. Yes, sir; about a third.

Senator NEUBERGER. What portion of that one-third would they divert; do you know?

Mr. FERNALD. The figure that I have heard is 15 million acre-feet.

Senator NEUBERGER. Is that about a third of the third or about 25 percent?

Mr. FERNALD. That is about 25 percent of the third.

Senator NEUBERGER. Which would be diverted.

Mr. FERNALD. Yes, sir.

Senator NEUBERGER. You have not studied the legality of the situation, I assume, have you?

Mr. FERNALD. No.

Senator NEUBERGER. I wrote out a few questions because I knew you were coming here today. I have asked you most of them.

I remember our talking about this both before and after I went up to Canada last October to talk to some of our Canadian friends. Have you yourself any sort of chronological sequence which you believe would be the most efficient in the United States, forgetting the Canadian project?

Mr. FERNALD. I don't understand your question.

Senator NEUBERGER. You have listed Libby and Mica Creek as did General Itschner, but they both involve Canadian negotiations; is that true? Let's just forget that. Assuming that we would go ahead then only with projects in the United States, have you set up in your own mind any sequence which would be the most efficient and effective and most desirable?

Mr. FERNALD. No, sir; except to follow the basic thesis that I mentioned before, that we are now at a point where we could use upstream storage both for power and for flood control, so it would be a storage project in the headwaters.

Senator NEUBERGER. That is all the questions I have, Mr. Fernald, unless Senator Dworshak has, and he well may.

Senator DWORSHAK. A couple, if you please.

Mr. Fernald, you said a few minutes ago you though there was an urgent need to construct additional flood-control storage in the upper Columbia River Basin.

Mr. FERNALD. Yes, sir.

Senator DWORSHAK. Could you be more specific and say on what tributaries that would be desirable?

For instance, let's confine the answer to the Snake, the Salmon, and the Clearwater, all of which are in the United States, we will just not take in the Canadian part of the Columbia.

Mr. FERNALD. Of the flood-producing streams of those three, you find the Salmon and the Clearwater probably the more important for control at this time because there is no control on them at the present.

Senator DWORSHAK. There is considerable on the Snake?

Mr. FERNALD. There is considerable control on the Snake in the sense that they have irrigation reservoirs and irrigation diversions all the way from Jackson Lake clear on down.

Senator DWORSHAK. They are not operated though essentially for flood control.

Mr. FERNALD. No.

Senator DWORSHAK. But they do assist.

Mr. FERNALD. They do assist.

Senator DWORSHAK. They store water and they run off in the spring.

Mr. FERNALD. Yes, sir; they use some water during those periods. Also the Palisades project on the Snake River, Anderson Ranch, and Arrowrock projects of the Bureau on the Boise and Lucky Peak projects of the Corps of Engineers on the Boise are operated for flood

control. Then there is the Cascade project on the Payette River which can be used for flood control. That is evaluating one stream against the other.

Senator DWORSHAK. How about the Salmon?

Mr. FERNALD. There is no control on the Salmon. Because of the importance of that stream to fishery, there doesn't seem to be any immediate prospect.

Senator DWORSHAK. Is there any way of installing fish ladders without interfering materially with the migration of salmon?

Mr. FERNALD. We hope, Senator, that sometime in the future we will be able to develop fish-passage facilities which will be sufficiently satisfactory so that it will be possible to obtain a project on the Salmon River.

Senator DWORSHAK. You haven't reached that point yet?

Mr. FERNALD. We haven't reached that point yet; no, sir; not to the extent that we can convince the fish people.

Senator DWORSHAK. How about the Clearwater storage outlook?

Mr. FERNALD. I believe I would second General Itschner's reply to that question. The fish problem in the Clearwater Basin is nowhere near as important as on the Salmon. The salmon runs on the Clearwater were stopped some years ago, in 1927 to be exact, by construction of a dam at Lewiston.

Senator DWORSHAK. Does that have fish ladders?

Mr. FERNALD. That had fish ladders in the original project; yes, sir.

Senator DWORSHAK. Were they successfully operated?

Mr. FERNALD. No, sir. They were a very primitive type of ladder which were constructed essentially on the spillway side of the channel. The fish which came up during the period when the spillway was in operation subsequently got over the ladder, primarily the steelheads. We still have a steelhead run in the Clearwater of some eight or nine or eleven thousand fish per year. The number of salmon at the present time, in the 1954 enumeration study of fish, which is only 1 year and not the whole story, indicated no salmon in 1954 and the average would be probably something on the order of 30 fish a year.

Senator DWORSHAK. The steelheads and the salmon get over the existing dams on the Clearwater?

Mr. FERNALD. If they came at a time between 1927 and 1940 that the spillway was in operation, then few got over. In 1940 they modified the fish ladders there and constructed fish ladders on the powerhouse side of the dam. That made it much easier for the fish to get past the project. However, the salmon in that 13 years had all been depleted and were never restored. Efforts are being made, I understand, to restore the runs on the Clearwater, and the potential for use by the salmon is the principal objection to the Clearwater project.

Senator DWORSHAK. Is the steelhead run continuing at maximum possibility?

Mr. FERNALD. The steelhead run is running around eight or nine thousand fish per year. I believe that is more or less the normal run.

Senator DWORSHAK. You know, of course, that the Federal Fish and Wildlife Service currently in this fiscal year has about $75,000 with which to conduct studies of fish problems in the Columbia River Basin, more essentially I should say probably in the middle Snake area. You are aware of that?

Mr. FERNALD. Yes, sir. They are spending money on the same type of problem that we are mentioning. They are working with the fish and game commissions of the States in an effort, first of all, to find some solution to the passage of fish. Also they have been working on the Clearwater with reference to the wildlife question there.

Senator DWORSHAK. Isn't it true that the Army Engineer Corps currently receives an annual appropriation of about a million dollars with which to make surveys and make installations of hatcheries and other such projects in the lower Columbia River Basin to facilitate and propagate the fisheries industry in the lower basin?

Mr. FERNALD. The lower Columbia River sanctuary program; yes, sir.

Senator DWORSHAK. About a million dollars a year?

Mr. FERNALD. I think it is on that general magnitude. I don't have the figures. Possibly the general has them. However, that money is included in the corps budget and is furnished to and used by the Fish and Wildlife Service. The Corps of Engineers has nothing to do with the direction of the program.

Senator DWORSHAK. That is because the Fish and Wildlife Service is considered to know more about fish problems than the Army Engineer Corps, although you are interested in those problems also.

Mr. FERNALD. That is their business.

Senator DWORSHAK. I mentioned the fisheries aspect of it because we have had quite an agitation in the upper basin, especially in the Clearwater area, on the part of the fish and wildlife organizations contending that the construction of any dam on the Clearwater River would seriously retard the migration of fish and affect wildlife in that particular part of the basin. You are aware of that, too?

Mr. FERNALD. Yes, sir.

Senator DWORSHAK. It would seem that we are in somewhat a dilemma if at the present time on the Snake River we have many installations primarily for irrigation which do take care of the flood menace on the Snake River, while on the Salmon and the Clearwater Rivers because of the aspects of propagating salmon fisheries there have been no flood-control projects. Isn't that sort of an inconsistent and somewhat illogical situation so far as the flood-control development is concerned?

Mr. FERNALD. I might answer it this way, Senator. The Clearwater Basin, as I mentioned the 1954 study showed, had no salmon and had about 9,000 steelheads. On the Salmon River the count for 1954 was about 25,000 salmon and 25,000 steelheads. That gives you the relative magnitude. For the Snake River, on the other hand, I don't have the figures available, but the figures for the Snake River and upstream were substantially less, in the neighborhood of 5,000 each of salmon and steelhead.

Senator DWORSHAK. It was pointed out this morning, and I share the apprehension over the potential flood threat in the Columbia River Basin this spring. I recall what happened in 1948 when we had the destruction of human lives and the devastation of much property. If we are facing recurrences of such floods this year and probably in the years ahead unless something is done to impound these floodwaters, then we are probably approaching the point where we have to make a determination whether taking care of the propagation of fish on the Salmon and the Clearwater is more impor-

tant to the Columbia River Basin than building flood-control projects which could conserve life in the lower basin. Maybe that isn't a professional question for you to answer, but I am just wondering if we are not virtually approaching that stalemate situation.

Mr. FERNALD. We hope we can break that stalemate, Senator, and have both fish and dams one of these days.

Senator DWORSHAK. It would appear so long as the fish and wildlife groups contend that those areas are sacred, such as the Clearwater, and that you can't build flood-control projects, then we will have to subject human life in the lower basin, the city of Portland and that area, as represented by the chairman——

Senator NEUBERGER. Acting chairman.

Senator DWORSHAK. The acting chairman, to the rather serious threats of jeopardizing human life.

Mr. FERNALD. We hope in this current report to be able to evaluate the fish and wildlife effects in dollars or in words and present those to the Congress with our recommendations.

Senator DWORSHAK. Are you cooperating with the Fish and Wildlife Service so you can tie into a single package and come up with some concrete recommendations?

Mr. FERNALD. We very definitely are. We have a fisheries advisory group made up of the directors of the State fish and wildlife agencies, a representative of the local director of the Fish and Wildlife Service, and the Fish and Wildlife Service is acting as the coordinating agency on all fish and wildlife matters.

Senator DWORSHAK. Do you think you will have an answer within the next year?

Mr. FERNALD. We hope to have an estimate of it by the end of the next year, yes, sir; not necessarily a full solution.

Senator DWORSHAK. That is all, Mr. Chairman.

Senator NEUBERGER. Following up the very useful questions asked by Senator Dworshak, is the problem on the Salmon, the question of getting the adult fish upstream or the small fish safely downstream?

Mr. FERNALD. The situation with the passage of the fish on the Salmon is the same as everywhere. There seems to be less problem with the adult fish, getting the adult fish upstream. There seems to be reasonable assurance that you can take adult fish up even if you have to put them in a truck and haul them up. The downstream migrants, however, present a problem because they are distributed generally over a pretty broad cross section of the reservoir area, and the necessity is to attract those fish or direct those fish into fish-passage facilities. We have been working toward that end with the University of Washington and with the fish and wildlife agencies, both State and Federal agencies, with a view to finding ways and means of actually guiding fish, either by light, by sound, by electricity, or by other means.

Senator NEUBERGER. Are the dams on the Salmon high dams?

Mr. FERNALD. Yes. If you were to build a storage project on the Salmon, they would be high dams. Run-of-river projects of lesser scope, of course, could be smaller dams and those would naturally be lower ones. We are talking about storage and they would be higher dams.

Senator NEUBERGER. Senator Dworshak raised the problem of flood control and I presume that would mean high dams in the canyons.

Mr. FERNALD. Yes, sir. It would have to be a high dam.

Senator DWORSHAK. Would a series of low dams serve the purpose as well or not?

Mr. FERNALD. In connection with the development of the Salmon River, in the 308 report we suggested both high dams and low dams. There was a storage project in the headwaters and then lower dams downstream.

Senator DWORSHAK. Would the lower dams present as serious a fish problem as high dams?

Mr. FERNALD. While it hasn't been conclusively proven yet there is evidence from the success at Bonneville and there probably will be further evidence from the success of McNary operations that dams of that height are not serious obstacles to fish. That of course is in the neighborhood of 100 feet. Higher projects in the neighborhood of 300 to 400 feet present entirely different problems.

Senator NEUBERGER. Senator Dworshak was talking about the flood danger, which is certainly brought home to all of us by the disastrous floods all over the Nation this past year. What is the relative discharge of the three great rivers of Idaho at their mouths?

To be fair, we might say the Snake where it unites with the Salmon, the Salmon where it discharges into the Snake, and the Clearwater where it unites with the Snake. Wouldn't that be a fair comparison of the three?

Senator DWORSHAK. Would that be on an average or normal basis or at flood tide?

Senator NEUBERGER. I presume if we compared them all with the same measuring stick it wouldn't make a great deal of difference.

Mr. FERNALD. We prepared some information here with reference to the two floods, the 1894 flood and the 1948 flood, comparing those floods, and I believe these figures have been used before. The Snake River at Oxbow in the 1894 flood was 130,000 second-feet, the Salmon River at White Bird was 120,000 second-feet, the Clearwater River at Spalding was 160,000 second-feet. Those are the peak flows on those individual streams. The Snake River at Clarkston, which is a combination of all three of those points, is 409,000 second-feet. That is the 1894 flood. They are fairly comparable, as you can see.

However, in volumes in acre-feet which contributed to the hydrograph at The Dalles above 800,000 second-feet—you can picture the hydrograph cut off at 800,000—the volume at Oxbow was 5,900,000 acre-feet, the volume on the Salmon River at White Bird was 5 million acre-feet, the volume on the Clearwater River at Spalding was about 5 million acre-feet, and the volume of the Snake River at Clarkston, which again includes those three, was 17,200,000 acre-feet.

Senator NEUBERGER. In other words, the three are about the same.

Mr. FERNALD. In the 1894 flood. If we take the 1948 flood we get a little different picture, Senator. Take the volumes, which I believe are most important, for the 1948 flood above the 700,000, which was our control level for the 1948 flood, the volume at Oxbow was 2,500,000 acre-feet, the volume of the Salmon at White Bird was 4,300,000 acre-feet, and the volume on the Clearwater on the Spalding was 5,600,000 acre-feet. At Clarkston, the total volume was 13,600,000 acre-feet. That shows a slightly different pattern.

Senator NEUBERGER. That is right.

Mr. FERNALD. There is no assurance, however, that a future flood will follow either of these patterns. It might be entirely different.

Senator DWORSHAK. Isn't the lower runoff of the Snake probably directly the result of building those various reclamation storage reservoirs on the Snake subsequent to 1894?

Mr. FERNALD. That 130,000 second-feet and the 5,900,000 I gave you for Oxbow are natural flows from a reconstitution of the 1894 flood as it existed. In 1948 there were irrigation developments, and I have no estimate of just what the degree of control was by those subsequent developments. Those are recorded flows.

Senator DWORSHAK. If the Snake River discharged in the 1948 flood less than half the water it discharged in the 1894 flood, then certainly there must be some reason for it and presumably it is at least partially due to the fact that reclamation reservoirs have been constructed at various points along the Snake River.

Mr. FERNALD. Those developments no doubt had an effect on it; yes. To what degree I am not prepared to say.

Senator DWORSHAK. The record would indicate that there has been a vast change, and it is only natural to assume that that is one of the reasons. There may be others, of course.

Mr. FERNALD. Yes, sir; that is correct. There might have been a different pattern of rainfall.

Senator DWORSHAK. There may have been a higher snowfall and higher depths in the other watersheds.

Mr. FERNALD. Yes, sir; that is correct.

Senator NEUBERGER. Do you have any more questions you would like to ask Mr. Fernald, Senator Dworshak?

Senator DWORSHAK. No, Mr. Chairman.

Senator NEUBERGER. Thank you very much, Mr. Fernald. We are always grateful for your vast store of information, both when you are here and when I am out in Portland to draw upon it.

Mr. FERNALD. You are very welcome, sir.

Senator NEUBERGER. Thank you so much.

I wonder if Mr. Willard Gatchell, the counsel of the Federal Power Commission, would come forward.

STATEMENT OF WILLARD W. GATCHELL, GENERAL COUNSEL, FEDERAL POWER COMMISSION, ACCOMPANIED BY FRANCIS L. ADAMS, CHIEF, BUREAU OF POWER; FRANK L. WEAVER, CHIEF, DIVISION OF RIVER BASINS; WILLIAM R. FARLEY, CHIEF, DIVISION OF LICENSED PROJECTS; AND JOHN C. MASON, ASSISTANT GENERAL COUNSEL

Senator NEUBERGER. We are sorry that we have kept you so long, but the Army engineers have so much information and are very useful witnesses.

Do you have a presentation which you care to make to the committee before any questions are asked, Mr. Gatchell?

Mr. GATCHELL. Mr. Chairman, my name is Willard W. Gatchell, general counsel of the Federal Power Commission. I have with me Mr. Francis L. Adams, Chief of the Bureau of Power; Frank L. Weaver, Chief of the Division of River Basins; William R. Farley, Chief of the Division of Licensed Projects; and John C. Mason, assistant

general counsel, who are all familiar with these problems in the Pacific Northwest to some extent.

If I may, sir, I will say that we are here in response to the letter from Chairman James E. Murray, under date of March 15, 1956, to Chairman Kuykendall, of the Federal Power Commission. If I may have that inserted at this time instead of reading it, I will read just one paragraph.

Senator NEUBERGER. It will be inserted in full.

(The letter referred to follows:)

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
March 15, 1956.

Hon. JEROME K. KUYKENDALL,
Commissioner, Federal Power Commission,
Washington, D. C.

DEAR MR. KUYKENDALL: Hearings of the Senate Committee on Interior and Insular Affairs with the Senate Committee on Foreign Relations on the problems related to the provision of adequate storage in the Columbia River Basin on both sides of the international border will commence Thursday, March 22, with the testimony of the representatives of the International Joint Commission and the State Department. The program is to have witnesses from the Corps of Engineers, the Federal Power Commission, and the Department of the Interior testify on the aspects of the problems relating to their work, on Monday, March 26, and continuing Wednesday, the 28th, if necessary.

The general information desired from all these agencies concerns the amounts of storage available and desirable at sites both in Canada and the United States under the various alternative plans of development and the effect of these various plans on the hydroelectric power potential of the entire basin, with particular reference to the interests of the United States. Particularly useful to the committee will be any testimony relating to the issues raised by Senator Neuberger in his report to me on the subject which is contained in our committee print of December 15, 1955, two copies of which I am enclosing.

In addition to the general information mentioned above, it would be appreciated if your agency can provide as full an explanation as possible of the current thinking of the Commission on the problem of charging downstream powerplants for the benefits resulting from upstream storage. It is emphasized that by mentioning this specific area for coverage there is no intention to exclude other areas of the problem which you may wish to present.

It is also requested that witnesses provide prepared statements for the use of committee members along with any factual data used in testifying. The provision of such material by Saturday, March 24, would be very helpful to the committee and staff and would permit the presentation in oral testimony of summaries of the prepared statements.

Please acknowledge this letter at your earliest convenience.

Sincerely yours,

JAMES E. MURRAY, *Chairman.*

Mr. GATCHELL. In the third paragraph Chairman Murray has this statement:

> In addition to the general information mentioned above, it would be appreciated if your agency can provide as full an explanation as possible of the current thinking of the Commission on the problem of charging downstream powerplants for the benefits resulting from upstream storage. It is emphasized that by mentioning this specific area for coverage there is no intention to exclude other areas of the problem which you may wish to present.

Under date of March 23, 1956, Chairman Kuykendall, of the Federal Power Commission, sent to Senator Murray, as chairman of this full committee, a letter which presents the Commission's present thinking on the problems that were presented by Senator Murray's first letter. I will ask that that be inserted at this time and then we will have the complete picture.

Senator NEUBERGER. It is so ordered, Mr. Gatchell.

(The letter referred to follows:)

FEDERAL POWER COMMISSION,
Washington, March 23, 1956.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington 25, D. C.

DEAR SENATOR MURRAY: This is in further response to your letter of March 15, 1956, concerning storage problems in the Columbia River Basin which was acknowledged by my letter of March 20, 1956.

The Commission has considered the request in the third paragraph that you be advised of our current thinking on the problem of charging downstream plants for benefits from upstream storage. As you know the Commission is now charged with the duty, under section 10 (f) of the Federal Power Act, of making determinations of benefits received by owners of non-Federal downstream powerplants from upstream storage reservoirs and assessing charges against those downstream owners. Since this has been a continuing function of the Commission without any significant recent change, it is assumed that your request relates to the Commission's current thinking with respect to pending bills which would modify section 10 (f) of the Federal Power Act to provide for the payment by Federal downstream power projects for benefits received from upstream storage reservoirs. Two such pending bills are S. 1574 and H. R. 7468, 84th Congress.

In response to a request from your committee on March 29, 1955, the Commission on May 5, 1955, transmitted to you its report on S. 1574, 84th Congress, a bill to provide for payments by the Secretary of the Interior to owners of non-Federal water-use facilities for hydroelectric power benefits realized by the United States therefrom, and for other purposes. A copy of this report is transmitted herewith. The Commission pointed out the relationship of S. 1574 to section 10 (f) of the Federal Power Act. Under S. 1574, the Secretary of the Interior would fix the amount to be paid for benfits from upstream storage and in addition the United States would pay the non-Federal owner of a reservoir for benefits received by a Federal power project. The Commission described the administrative difficulties which would result in the dual authority of the Secretary of the Interior and the Commission and recommended an amendment fo section 10 (f) of the Federal Power Act in lieu of S. 1574 to require, among other things, payments by the United States for benefits received by a Federal hydroelectric project from a non-Federal reservoir or other water-use facility.

On May 27, 1955, our General Counsel, Mr. Willard W. Gatchell, appeared before your committee and submitted a statement on the Commission's proposed substitute for S. 1574 in which he said, among other things:

"In other words, the bill merely provides that all power consumers, whether served by Federal or by non-Federal powerplants, are to share in the headwater reservoir costs where power benefits are received from storage so provided.

"It will be seen that this is not a charge for the water but a sharing of the costs of facilities which make the water available when it can be utilized."

Also, in a letter dated July 8, 1955, to Chairman Clinton P. Anderson, of the Subcommittee on Irrigation and Reclamation of the Senate Committee on Interior and Insular Affairs, Mr. Gatchell discussed two questions raised concerning the amendment of section 10 (f) as proposed by the Commission. He explained that neither the language nor the intent of the proposed amendment would require payment by the irrigation phase of a downstream multiple-purpose project for benefits received from an upstream storage reservoir, such payments being limited to power phases alone. He further explained that operating costs (not included in sec. 10 (f) as now written) would be included in the costs to be apportioned under the proposed amendment of section 10 (f) since they are as much a part of the expense of making the benefit available from an upstream reservoir as are interest, maintenance, and depreciation. A copy of Mr. Gatchell's letter of July 8, 1955, is transmitted herewith.

In response to a request from the chairman of the House Committee on Interstate and Foreign Commerce, the Commission on January 19, 1956, submitted a report on H. R. 7468, 84th Congress, a bill to amend part I of the Federal Power Act. A copy of this report is transmitted herewith. This bill would, among other things, amend section 10 (f) in the same way as was proposed by the Commission as substitute for S. 1574. The Commission report included the following statement concerning the provisions of H. R. 7468 which would amend section 10 (f):

"The Commission believes that the proposed legislative authority providing for the payment by Federal hydroelectric developments for headwater benefits received from non-Federal water resource projects is sound in principle and essential to the more effective carrying out of the purposes of existing Federal waterpower legislation. Congress has followed the policy heretofore of requiring that those consumers served by federally constructed powerplants shall bear all of the power costs. The only exception to this policy, and one which would be corrected by the amendments proposed in sections 1 and 2 of this bill, is the failure to require that consumers of power from Federal projects share in the cost of headwater improvements which benefit those Federal developments.

"When a Federal powerplant receives water that has been stored at an upstream development and the Federal plant can utilize that water for generating power, there is no provision at present for the reimbursement of the owner of the upper storage reservoir for any part of the cost of his reservoir, notwithstanding the benefits derived by the lower Federal powerplant. However, if the benefits are received by a downstream powerplant owned by a State, municipality, or privately owned company, section 10 (f) of the Federal Power Act now requires such owner to pay part of the costs of the upper storage reservoir providing the benefits. This bill would remove the exemption now enjoyed by Federal developments, thereby placing all power consumers on an equal footing. In other words, the bill merely provides that all power consumers, whether served by Federal or by non-Federal powerplants, are to share in the headwater reservoir costs where power benefits are received from storage so provided.

"It should be noted that the headwater benefit charges under existing law as well as the charges provided by the amendments proposed in sections 1 and 2 of this bill are not charges for water but are a sharing of the costs of facilities which make the water available when it can be utilized for power generation."

In its reports on S. 1574 and H. R. 7468, the Commission recommended enactment of legislation which would provide for payment by Federal downstream plants for benefits received from upstream storage. The Commission still favors such legislation.

It would appear that the Commission could be of assistance to your committee by having Mr. Gatchell available at the hearing on March 26 and on March 28 to discuss the downstream benefit problem as it relates to our responsibilities under section 10 (f) of the Federal Power Act. Other staff members will also be present to answer questions on technical matters that may arise.

In the second paragraph of your letter you stated that general information on the problem of storage in the Columbia River Basin is desired from the Corps of Engineers, Federal Power Commission, and the Department of the Interior. In this connection the committee's attention is invited to the resolution of the Senate Committee on Public Works, adopted July 28, 1955. That resolution requested the Board of Engineers for Rivers and Harbors to review the report on the Columbia River and tributaries published as House Document No. 531, 81st Congress, and other reports, "particularly with regard to present requirements of flood control including consideration of flood storage in Canada; the present needs of navigation; a restudy of hydroelectric power potentialities as part of a combined hydro-thermal system; and consideration of all related water uses." This review is now underway by the Corps of Engineers with the cooperation of other Federal agencies including the Federal Power Commission and is scheduled for completion in the fall of 1957.

While the Commission is familiar with the past plans for the overall development of the Columbia River Basin, its participation in the cooperative study now being undertaken pursuant to the above resolution is directed primarily to such matters as the hydroelectric power that could be developed at proposed projects, the value of such power, and the power market in the Northwest region. This study has not yet progressed to the point of having available sufficient data on which to base conclusions with respect to the effect of Canadian storage on the hydroelectric power potential of the entire basin. Hence we are unable to furnish you at this time any pertinent information on the subject requested in the second paragraph of your letter, other than information which has previously been developed as the result of prior studies.

The Commission has given consideration to the issues raised by Senator Neuberger in his report submitted to you December 9, 1955, and the substantive recommendations therein and has concluded that the recommendations appear

to involve matters of congressional policy on which the Commission does not feel it appropriate to comment.

Sincerely yours,

JEROME K. KUYKENDALL,
Chairman.

[Enclosures]

REPORT ON S. 1574, 84TH CONGRESS

A Bill To Provide for Payments by the Secretary of the Interior to Owners of non-Federal Water-Use Facilities for Hydroelectric Power Benefits Realized by the United States Therefrom, and for Other Purposes

This bill provides that in those cases where any hydroelectric power facility owned by the United States is benefited by the construction and operation of any reservoir by another party (State, municipality, person, or private corporation), the United States shall pay to the other party an annual charge not to exceed the value of the benefits realized or a portion of the costs of the non-Federal facility furnishing the benefits. Recommendation as to the amount of such charge is to be made to the Congress by the Secretary of the Interior, or other agency head having administrative jurisdiction of the marketing of the power from the Federal hydroelectric facility.

Section 3 of the bill provides for similar annual payments with respect to payments to the United States by another party where any water-use facility owned by the United States benefits a hydroelectric power project owned by another party. The Secretary of the Interior, or other agency head having administrative jurisdiction over the Federal water-use facility, is directed to fix the charge. Provision is also made for debits and credits on the books of the Treasury Department between different Federal agencies on account of the benefits realized by a federally owned hydroelectric power project from the construction or operation of a federally owned water-use facility.

Section 4 of the bill provides that the Secretary of the Interior shall fix annual payments to be made between parties other than the United States where the water-use facility of one party benefits a hydroelectric power project of the other party.

Section 10 (f) of the Federal Power Act (16 U. S. C. 803 (f)) provides that when licensees are benefited by reservoirs or other headwater improvements constructed by other parties, including the United States, they shall reimburse the owner of the improvement for such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission may deem equitable. By the third paragraph of section 10 (f) (which was added in 1935), the requirement for payments for headwater benefits was imposed upon nonlicensees under certain circumstances.

It thus appears that the bill would attempt to provide for the same sharing of headwater improvement costs as provided by Congress in section 10 (f) of the Federal Power Act. However, the bill would not accomplish this objective by amending the Federal Power Act but, in effect would repeal section 10 (f) of the Federal Power Act and transfer to the Secretary of the Interior the authority to determine charges to be paid and to assess them against the proper parties, instead of working through the Federal Power Commission as at present.

This arrangement would be extremely awkward, with the Commission having jurisdiction over new licensees for other purposes and over existing licensees for this and all other purposes, and the Secretary of the Interior having jurisdiction for this limited purpose over some licensees but not having a basis for making the jurisdictional determinations inherent in the proposal or for determining the benefits received. Also the bill could not apply even in this respect to outstanding licenses under the Federal Power Act for those licenses may be amended only with the mutual consent of each licensee and the Commission.

Moreover the bill raises some procedural questions which have already been settled by Congress in the Federal Power Act; namely, the manner in which parties may apply for and secure and have reviewed a determination of the headwater benefits received and the costs to be shared. In order to provide a fully effective means of administering this bill, corresponding provisions would have to be enacted providing for notices, hearings, rehearings, court review, and enforcement of determination orders.

The Commission is in complete agreement with the substantive proposal of the bill to provide for annual payments for headwater benefits received by non-Federal power developments and for similar annual payments by the United

States which in like manner receives benefits at federally owned power projects. The Commission has so recommended and again urges that section 10 (f) of the Federal Power Act be amended accordingly. It does not recommend passage of this bill but recommends in lieu thereof that the entire bill be stricken after the enacting clause and that language somewhat along the lines of the attached substitute be enacted in lieu thereof.

FEDERAL POWER COMMISSION,
By JEROME K. KUYKENDALL,
Chairman.

SUBSTITUTE SECTION 31 OF FEDERAL POWER ACT

The Federal Power Commission recommends that the bill S. 1574 be stricken after the enacting clause and that the following be substituted in lieu thereof:

That subsection (f) of section 10 of the Federal Power Act (16 U. S. C., sec. 803 (f)) is hereby repealed.

SEC. 2. That the following new section be added to the Federal Power Act:

"SEC. 31. (a) Whenever any hydroelectric power project owned by non-Federal interests is or will be benefited by the construction, operation, or maintenance of any reservoir or other water-use facility, the Commission, after notice to the owner or owners of any project so benefited, and after opportunity for hearing, shall determine and fix a reasonable and equitable annual charge to be paid to the owner of such facility furnishing such benefits, including the United States if it be the owner of the facility providing the benefit. The annual charges hereunder shall be such part of the fixed costs of the facility furnishing the benefit plus such part of the annual operating and maintenance costs of such facility, including land rentals and similar charges, as the Commission may deem equitable: *Provided*, That such annual charges shall not exceed the value of the benefits realized or received.

"(b) Whenever any hydroelectric power project owned by the United States is or will be benefited by the construction, operation, or maintenance of any reservoir or other water-use facility, the Commission, after notice to the Federal agency operating the project so benefited and the Federal agency or owner of the facility furnishing the benefit, and after opportunity for hearing, shall determine and fix a reasonable and equitable annual charge to be paid to the owner of such facility furnishing such benefits, such charge to be determined as provided in the preceding paragraph: *Provided*, That payments shall be required for benefits furnished by one Federal facility to another only if the cost of operating one of said facilities is payable from a revolving fund, and the cost of operating the other is payable from some other fund or direct appropriation: *Provided further*, That where no payment is required, the charges determined shall nevertheless be considered as an expense of the facility receiving the benefit and as accrued revenue of the other facility, with an appropriate equal adjustment in the repayable Government capital invested in each such facility.

"(c) Annual charges assessed hereunder may be readjusted by the Commission at periods of not less than five years after notice and opportunity for hearing or readjusted at any time by the Commission as changed conditions may warrant after notice and opportunity for hearing.

"(d) All charges collected for the benefits provided by any facility owned by the United States shall constitute revenues of the facility providing the benefit and such revenues shall be disposed of in accordance with any provisions of law applicable thereto.

"(e) All parties affected by any determination hereunder (except any agency of the United States in each instance where the cost of operating the facility involved is financed by direct appropriations) shall bear a reasonable share of the cost to the Commission of making the determination, and all such parties shall pay their share of such cost, as fixed by the Commission, into the Treasury of the United States for credit to miscellaneous receipts: *Provided*, That for those Federal facilities where payment into the Treasury is not required by this paragraph, the reasonable share of the cost as fixed by the Commission shall nevertheless be considered as an expense of the facility involved.

"(f) Appropriations or other funds available for operation of the facility concerned shall be available to pay the annual or other charges that may be assessed against the United States pursuant to the provisions of this section.

"(g) No party receiving a notice under subsection (a) or (b) of this section shall be required to pay annual charges under this section for benefits received prior to the enactment of this section or be required to pay annual charges under

this section for benefits received more than five years prior to the date on which the Commission gives notice to such party as provided in subsections (a) and (b) hereof; nor shall any party receiving a notice under subsection (a) of this section be required to pay to any non-Federal interest annual charges under this section if it is paying or is required to pay similar annual charges under State law."

REPORT ON H. R. 7468, 84TH CONGRESS

A Bill To Amend Part I of the Federal Power Act

Sections 1 and 2 of this bill would repeal section 10 (f) of the Federal Power Act and enact a new section 31, which would require not only reimbursement by non-Federal power developers for benefits accruing to them from upstream facilities constructed by another, as does the present section 10 (f), but also require reimbursement by the United States for such improvements when constructed by non-Federal interests. Annual charges thus assessed could be readjusted by the Commission at 5-year intervals after notice and opportunity for hearing.

The Commission is in complete agreement with the proposal of the bill to provide for annual payments for headwater benefits received by non-Federal power developments and for similar annual payments by the United States. The Commission has consistently recommended that the Federal Power Act be so amended, and accordingly in its report of May 5, 1955, to the Senate Interior and Insular Affairs Committee on S. 1574, 84th Congress, urged enactment of amendatory language which is identical to that contained in section 2 of H. R. 7468.

The Commission believes that the proposed legislative authority providing for the payment by Federal hydroelectric developments for headwater benefits received from non-Federal water-resource projects is sound in principle and essential to the more effective carrying out of the purposes of existing Federal waterpower legislation. Congress has followed the policy heretofore of requiring that those consumers served by federally constructed powerplants shall bear all of the power costs. The only exception to this policy, and one which would be corrected by the amendments proposed in sections 1 and 2 of this bill, is the failure to require that consumers of power from Federal projects share in the cost of headwater improvements which benefit those Federal developments.

When a Federal powerplant receives water that has been stored at an upstream development and the Federal plant can utilize that water for generating power, there is no provision at present for the reimbursement of the owner of the upper storage reservoir for any part of the cost of his reservoir, notwithstanding the benefits derived by the lower Federal powerplant. However, if the benefits are received by a downstream powerplant owned by a State, municipality, or privately owned company, section 10 (f) of the Federal Power Act now requires such owner to pay part of the costs of the upper storage reservoir providing the benefits. This bill would remove the exemption now enjoyed by Federal developments, thereby placing all power consumers on an equal footing. In other words, the bill merely provides that all power consumers, whether served by Federal or by non-Federal powerplants, are to share in the headwater reservoir costs where power benefits are received from storage so provided.

It should be noted that the headwater benefit charges under existing law as well as the charges provided by the amendments proposed in sections 1 and 2 of this bill are not charges for water but are a sharing of the costs of facilities which make the water available when it can be utilized for power generation.

Sections 3, 4, and 5 of the bill, by raising the limit of the so-called minor projects from 100 to 2,000 horsepower, would exempt from certain licensing provisions of the act projects of 2,000 horsepower or less. The Commission in its annual reports to Congress for 1951 and subsequent years has advocated that the Federal Power Act be amended to raise the limit for minor projects.

As of June 30, 1955, there were outstanding 227 major licenses, that is, projects having more than 100 horsepower installed capacity. Of this number there were 65 major licenses for projects having 2,000 horsepower or less capacity, 42 of which are used for electric utility purposes, 20 for industrial purposes, and 3 for resort or domestic purposes. Inasmuch as projects of 2,000 horsepower or less capacity do not at present appear to be of gerat importance in the development of hydroelectric waterpower resources, there would seem to be no serious objection to raising the limit for minor projects to 2,000 horsepower as provided by this bill.

Section 6 of the bill proposes to amend section 15 of the Federal Power Act to provide that if the United States does not take over a licensed project at the end of the license period, and if the licensee has made an application for a new license, the Commission shall issue a new license to the licensee upon such terms as may be authorized or required under the then existing laws. Such an amendment should tend to eliminate much of the opposition to license terms of less than 50 years and back dating the effective dates of licenses, particularly for constructed projects. The present act, by providing opportunity for the Commission to review the facts at the termination of the license period, is designed to safeguard the general public interest in comprehensive planning of water-resources development consistently with fostering beneficial public uses for all purposes. This opportunity for Commission review at the expiration of a license would not be affected by the bill.

The Commission recommends enactment of H. R. 7468. Commissioner Connole did not participate in recommendations on sections 1, 2, and 6 of the bill for the reasons set forth in his statement which is attached.

FEDERAL POWER COMMISSION,
By JEROME K. KUYKENDALL, *Chairman.*

IN THE MATTER OF H. R. 7468

Connole, Commissioner, concurring in part:

Sections 1 and 2 and section 6 of this proposed legislation would change matters of congressional policy as expressed in the act as it now reads. I am convinced that this Commission has no right, as an agency of the Congress, to express an opinion on such matters, unless it has persuasive facts or reasons at its disposal not available to the Congress. Since none such have been brought to my attention, I feel the Commission has no jurisdiction to urge these changes.

Sections 3, 4, and 5, however, would facilitate the administration of and more effectively promote the present policy of the act as it now reads. These conclusions result from the experience of the Commission in administering the act in its present form, an experience denied to the Congress and specifically entrusted to the Commission. On these points I support the majority and urge the enactment of the legislation.

WILLIAM R. CONNOLE, *Commissioner.*

JULY 8, 1955.

Re S. 1574, 84th Congress.

Hon. CLINTON P. ANDERSON,
Chairman, Subcommittee on Irrigation and Reclamation,
Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

DEAR SENATOR ANDERSON: As requested I have corrected the stenographic transcript of my testimony before your subcommittee on the bill (S. 1574) which would provide for headwater benefit payments by hydroelectric power projects. It had been my purpose in testifying to give a full explanation of the effect of the amendment proposed by the Federal Power Commission by which a new section 31 would be added to the Federal Power Act. Apparently, however, two questions were subsequently raised which I should have discussed.

One question concerned the possibility of imposing headwater benefit charges under the new section 31 against irrigation benefits when upstream stored water is subsequently utilized at a downstream multiple-purpose project not only for developing power but for irrigation. However, such a possibility is not present in the new section 31. The language of the Commission's proposed amendment is clear, for it limits the benefits to be considered to benefits to "any hydroelectric project" whether owned by a non-Federal interest (par. (a)) or by the United States (par. (b)). The Commission has no intention of suggesting to Congress that if water should be used for irrigation purposes after being released from upstream storage headwater benefit charges should be imposed for the irrigation benefit, and the expressed language of section 31 effectively precludes such imposition. The only benefits which can be considered under the proposed section 31 would be benefits received at a hydroelectric project. An illustration could be given by considering the Grand Coulee multiple-purpose development for irrigation, navigation, and power. All of these purposes might be benefited by having flood flows stored upstream and low flows augmented from the upstream storage. But the only benefit which could be considered under section 31 would be the power benefit at the hydroelectric power project.

The other point was raised more as an inquiry by Mr. Irvin Hoff, who was representing Senators Magnuson and Jackson. He called attention to the fact that section 10 (f) now calls upon the Commission to fix an equitable proportion of the annual charges for interest, maintenance, and depreciation on the upstream storage reservoir, whereas the proposed section 31 prescribes that the annual charges shall be "such part of the fixed cost of the facility furnishing the benefit, plus such part of the annual operating and maintenance cost of such facility, including land rental and similar charges, as the Commission may deem equitable."

I had not discussed this change because it does not appear to me to be significant, although it should have been explained. The new language adds operating costs to the elements of the cost of headwater facilities being considered in fixing the annual charges.

This was proposed because the operating costs are as much a part of the expense of making the benefit available from the upstream reservoir as the interest, maintenance, and depreciation. The land rentals were expressly mentioned because question has been raised as to the inclusion of land rentals in operating expenses, and it was considered desirable to remove all doubt on this particular point. The cost of land owned in fee simple is covered by the interest charge, and there did not appear to be any valid reason for excluding land rentals if the costs of the upstream reservoir are to be covered, as presumably are intended to be.

Actually, the annual charges which the United States would be called upon to pay at any project could not be substantial and by way of illustration our engineering staff has roughly estimated the charges against the United States in the Columbia River system for the year 1959 when the Dalles powerplant will be 50 percent in operation and the other Federal powerplants will be in operation. For that year it is estimated that headwater benefit charges payable for benefits received by the Federal hydroelectric power projects would be approximately $300,000; the Bonneville Power Administration will sell approximately 32.3 billion kilowatt-hours of electric energy for which it will receive around $72,400,000. The headwater benefit charges under the proposed section 31 would amount to about 0.4 percent of the revenues or about 0.01 mill per kilowatt-hour.

Finally, whatever charges are paid to a privately owned power company under section 10 (f) or under the proposed section 31 would be accountable as other income and where regulated by a State agency or by the Federal Power Commission would be considered in fixing the rates. The Federal Power Act looks to a limitation of the profits of such licensees to a reasonable return and a part of any excess earnings of licensees must be set aside in an amortization reserve to reduce the net investment in the project.

Respectfully submitted.

WILLARD W. GATCHELL, *General Counsel.*

Mr. GATCHELL. We are here to answer any questions that you or the committee may have.

Senator NEUBERGER. We thank you for coming today, sir. I will ask a few questions, if I may, Mr. Gatchell. I have not had the opportunity to read your reply so I will ask you a few general questions which I had in mind which I wrote out, knowing you would be here, in view also of such knowledge that I had of the chairman's letter to you of March 15 requesting information from you.

Has the Federal Power Commission ever given any consideration to the future of the Canadian section of the upper Columbia in judging what is a comprehensive plan for the Columbia system?

I think under the FPC Act you are charged with comprehensive development of these river systems or of authorizing it if it is put to you.

Mr. GATCHELL. The Commission does consider, Mr. Chairman, the comprehensive development of the basin. The Commission participated in the studies which have been made in the 308 report submitted in House Document 531 by the Army engineers. That, of course, did take in the Canadian situation as it was then presented. It also, as you know, passes correctly upon applications for licenses to develop

certain sites and in that connection must, of course, consider the entire basin as respects that project. When a project is located on a particular stream such as the Snake, then of course the considerations are different from what the Commission considered in connection with the Cowlitz and Deschutes projects on those rivers.

Senator NEUBERGER. I want to return to that a little bit. Has the Commission set up what it regards as comprehensive use of the upper Columbia, just to put it in a nutshell?

Mr. GATCHELL. Yes, sir; I would think there is no question on that score. Yes, sir; the Commission has considered the comprehensive development insofar as the power phases of the Federal river basin planning which has been mentioned by General Itschner here.

Senator NEUBERGER. What development of the upper Columbia has the Commission assumed, then? What specifically?

Mr. GATCHELL. I would have to ask Mr. Weaver or Mr. Farley.

Senator NEUBERGER. Would you give your name for the record?

Mr. FARLEY. My name is William R. Farley, Chief of the Division of Licensed Projects.

The question is a little broad because it may go to different phases of the Commission's work. For instance, the Commission does participate in the interagency work. It is participating in the present review of the report. To the same extent they are reviewing it along with and in the same manner as the Corps of Engineers, although certain of their functions are a little more specific.

Senator NEUBERGER. Let me get down to cases then. You said the question was a little broad, and I am sure you are correct. I asked both General Itschner and Mr. Fernald, assuming there was no international boundary, what sequence of development on the Columbia River they would recommend, and both of them said, giving it as their opinion right today, that they would recommend Libby first and Mica Creek second, of all the projects now under review or being considered.

Has the FPC gone so far as to have an opinion on that same general subject?

Mr. FARLEY. I am afraid I may have to call for some more help here. I am not trying to dodge you.

Senator NEUBERGER. We have lots of chairs.

Mr. FARLEY. I happen to be engaged chiefly in the licensing function, and Mr. Adams is the Chief of the Bureau.

Senator NEUBERGER. I want to say you people will be the last witnesses today. If Senator Scott or Senator Dworshak want to come in on any of this please do so. There is no protocol here with only an acting chairman.

The reason I asked this question, I think it is extremely important for the Congress to know because the Columbia River is a great resource and, if possible, the best way to develop it would be if we could develop it without considering the international boundary because that is a purely artificial element that we thrust into the Almighty's handiwork. It is important to have on the record what General Itschner and Mr. Fernald said, that they happen to agree that of all the projects under review and discussion, they would put Libby first and Mica Creek second. I think it is also important to ask that same question of the FPC.

Mr. GATCHELL. If you would like that as a Commission viewpoint I presume you would have to present that to the Commission and get their views on it.

Senator NEUBERGER. I am asking the technical staff. It seems to me it is not so much a policy question as a question of your studies, what they have indicated.

Mr. GATCHELL. The economic engineering studies. Mr. Adams ought to be able to answer that.

Mr. ADAMS. Francis L. Adams, Chief of the Bureau of Power of the Federal Power Commission.

Senator Neuberger, if I understand your question, you asked if we had reached any conclusion as to whether Libby or Mica Creek should come first as the next development of the river.

Senator NEUBERGER. No; I didn't ask that. What I asked was which projects, because there are lots of others, those in the United States, too. The question I am asking is, assuming there is no international boundary, just which is the next project or projects in sequence that you think would be most advisable, practicable, feasible, to build on the Columbia River system?

Mr. ADAMS. Senator, I think we can say in answer to that that we have not made any study to determine just that point, which would be the next in sequence. We have considered it along with the Corps of Engineers in the cooperative study of the Columbia. There are many possibilities of development of the Columbia. We have not attempted to determine the order of development.

Senator NEUBERGER. So you have no opinion or viewpoint on that?

Mr. ADAMS. No, sir; I don't believe we could answer that question.

Senator NEUBERGER. Then we will go on to the next question. How long has the FPC been studying the question of downstream benefits from upstream storage? A long time?

Mr. ADAMS. The Commission has had under study under section 10 (f) of the Federal Power Act a general investigation of the headwater benefit problem in the Columbia Basin, started about 2 years ago, with a view to determining what the effect might be on the Bonneville rates when the Bonneville Administrator asked for review of their rates. That study has not been pressed to the point of completion, so we don't have any conclusive information at this time.

Senator NEUBERGER. Hasn't the FPC made more study than any other agency, if I am not mistaken, about how upstream storage will be compensated for in the form of downstream benefits? Haven't you made quite extensive studies of that?

Mr. GATCHELL. Yes. You were not limiting your inquiry to the Columbia River, but the Commission generally? I think the answer to that would be "Yes, the Commission has made studies. First the determination was made on the Big Creek area in California. We made a determination of headwater benefits out there.

Senator NEUBERGER. Have you made any studies as to how downstream benefits would be compensated for in connection with the use of the Columbia River by the two nations?

Mr. ADAMS. No, sir; we have not, although we plan to go into that subject during the current cooperative study with the Corps of Engineers and their review of House Document 531. That is a part of the program of study.

Senator NEUBERGER. But you have not made any now?

Mr. ADAMS. We did take part in a joint study with the Corps of Engineers and the Department of the Interior, and published a summary report in April of 1955 which came up with the general conclusions as to the value of Mica Creek, Libby, and Arrow Lakes, in the initial phases of development as compared to the long-range phases of development.

Mr. GATCHELL. I might add right there, Senator Neuberger, that the Commission did consider the effects of headwater benefits and the possibility of assessing charges on the Columbia River, making the determinations up to 1948, and decided that by reason of the balancing out not to proceed with it because the companies that were involved with the Bonneville administration decided it would not be economically desirable to continue. It came so close to a balancing out. That involved quite a detailed study.

Senator NEUBERGER. In other words, then, you don't have any definite information to give us as to how you think the United States, let us say, should compensate Canada for downstream benefits from Canadian storage.

Mr. ADAMS. No, sir. We have not made any determination along that line other than the summary report that I mentioned which was made in cooperation with the other agencies.

Senator NEUBERGER. Did that contain recommendations on this? I find a Senator can't read every report.

Mr. ADAMS. It did not contain recommendations. It did contain the general conclusion that as time goes on and the additional storage is brought in, the Canadian storage would have a diminishing value to the United States, depending upon the period in which it is brought in.

Senator NEUBERGER. Did that study assume Canadian storage would be brought in after all the American projects?

Mr. ADAMS. It made two assumptions. One, if it were brought in at the present so-called base level system, the value would be so much, and then if brought in later at the so-called C level system it would have a somewhat less value.

Senator NEUBERGER. In other words, if it were brought in now it would be more valuable than if brought in after the C system.

Mr. ADAMS. That is right.

Senator NEUBERGER. But did the report assume whether it was brought in now or later—or did it just project two hypotheses?

Mr. ADAMS. It was the latter.

Senator NEUBERGER. Again you didn't place a measuring stick as to how the benefit should be determined?

Mr. ADAMS. No; that was not evaluated in the report.

Senator NEUBERGER. I think that is about all. I gather that you people have not yet made a great deal of specific study of this particular situation.

Mr. GATCHELL. Senator, I might explain the function which the Power Commission exercises in this respect. You are directing your attention mainly to the evaluation of the benefits between the two countries, and the Commission makes that examination in connection with these comprehensive studies that the Army engineers engage in. Then in its determination of headwater benefit charges it considers a more restricted phase of the headwater benefit problems. In other words, under section 10 (f) of the act the Commission considers only those things which Congress has directed should be regarded as

the standard upon which annual charges should be predicated for headwater benefits received. Therefore, it is on an entirely different basis from the broader one and the more proper one which I think you are considering in connection with evaluating the Canadian and the United States developments.

Senator NEUBERGER. The reason I ask this question so much, Mr. Gatchell, is this: I find when I talk with the Canadians what they are going to do is very largely predicated on what benefits they think their projects would confer upon downstream dams in the United States and what they could receive in terms of that.

Mr. GATCHELL. That is proper. They want to see what the benefits would be in a very tangible way, and I think that is perfectly all right. Those things are the very things that the Commission considers in connection with its broad studies.

Senator NEUBERGER. The reason it is so important for us to have it is that right this year they are studying this diversion. It is my understanding that there are engineering surveys in the field now studying what the costs would be of the diversions, to divert that 14 million acre-feet by tunnel into the Fraser River system. They are going to measure that against what our formula may be on this downstream situation.

Senator Scott or Senator Dworshak, do you have any questions?

Senator DWORSHAK. Just one question. I was wondering, Mr. Gatchell, whether the FCP has completed any study involving downstream benefits this side of the border and restricting that entirely to projects within the United States.

Mr. GATCHELL. No, sir; but it did complete the one up to 1948. It did complete that study.

Senator DWORSHAK. On which river?

Mr. GATCHELL. You mean just in the Columbia River Basin? It has completed other studies in other river basins, but are you directing your question just to the Columbia River Basin?

Senator DWORSHAK. Both. I wanted to know generally in other basins and also specifically in the Columbia.

Mr. FARLEY. There has been another one completed on the Alabama Coosa for benefits conferred by the Government to the Altoona project in Georgia, benefits which were furnished to plants of the Alabama Power Co. on the Coosa River.

Senator DWORSHAK. You completed those?

Mr. FARLEY. Yes.

Senator DWORSHAK. You have completed some on the Columbia River, too?

Mr. FARLEY. There was one completed for the period 1931 to 1948, the projects which were in operation at that time on the Columbia River. The result was that the principal beneficiary was the Rock Island project then owned by Puget Sound Power & Light Co. In view of the fact that it had only what you might call the initial installation, it was not able to use to advantage the regulated flow from Grand Coulee and other upstream reservoirs. So as a result it was found over that period that such benefits and damages as there were resulted in no determination of positive benefit.

Senator DWORSHAK. No legislation has been enacted which would authorize an interchange of benefits between the various dams on the Columbia River Basin?

Mr. GATCHELL. Oh, yes, Senator. Under section 10 (f) of the Federal Power Act——

Senator DWORSHAK. You are authorized to do that?

Mr. GATCHELL. We are authorized to do that solely by charging non-Federal developments. The Federal projects do not pay and are not to be charged with any benefit that they receive. The Commission has recommended amendment of the Federal Power Act to take care of that situation, but at the present time only non-Federal power projects pay headwater benefit charges.

Senator DWORSHAK. Then actually you have in operation now a system whereby privately constructed and operated storage projects to pay for benefits derived from other Federal installations on the river and likewise where the private projects receive no payment for benefits accruing to the Federal projects.

Mr. GATCHELL. No; it really is not private because there are a number of public-utility districts that are non-Federal that might be benefited up in that section. They pay for benefits received. They pay a part of the cost of the development. They pay for those benefits received at the non-Federal developments. There are no payments exacted of Federal power projects which received headwater benefits by reason of storage at some non-Federal reservoir.

Senator DWORSHAK. There probably are non-Federal reservoirs that do give some benefits to Federal projects.

Mr. GATCHELL. Yes, sir. The Flathead Reservoir is one of them. It certainly benefits all of the Federal projects downstream, but there are no charges assessed.

Senator NEUBERGER. Is that all you have, Senator Dworshak?

Senator DWORSHAK. That is all.

Senator NEUBERGER. When you were figuring out the charges to be made for downstream benefits what were the elements contained in that?

Mr. GATCHELL. If you mean what is the statutory requirement that the Commission shall predicate it on, it says that it shall pay the owner of the headwater reservoir which furnishes these benefits for "such part of the annual charges for interest, maintenance, and depreciation thereon as the Commission may deem equitable."

That means that if the Grand Coulee benefits, as it does, the Rock Island plant, which now has been taken over entirely by the Chelan Public Utility District, when the Grand Coulee Reservoir does benefit that, we figure the interest, maintenance, and depreciation on the Grand Coulee Reservoir for the purpose of assessing a part of that cost against the Rock Island power output.

Senator NEUBERGER. In view of all these difficulties which are involved in the Canadian situation and the international controversy and litigation, do you feel that the Commission in the future should license any projects which provide less than the full amount of storage that might be available at sites in the United States?

Mr. GATCHELL. The Commission has been very careful so far as I know not to license any project that had storage available where it didn't secure the maximum utilization of that particular site. I don't know just what you have in mind in that connection, but certainly section 10 (a) requires the Commission to consider the entire development for the purpose of seeing whether it was making the maximum use of those particular water resources.

Senator NEUBERGER. I may be wrong about this and don't have the figures available. Does the present plan at Hells Canyon provide as much storage as the Federal dam in House Document 531?

Mr. GATCHELL. I believe the House Document 531 figures were modified when they presented the same evidence before the Commission and they gave a figure actually or storage during the 1894 flood, a figure of 2,300,000 acre-feet would be available at the high Hells Canyon Dam, Federal dam, at that point.

The Commission required an installation of enough storage so that they would have a million acre-feet of flood-control storage at these three dams authorized under the license issued by the Commission.

Senator NEUBERGER. I don't want to quarrel about figures with you, Mr. Gatchell, because I am certainly not an expert. I notice that General Itschner was still presenting today 3,280,000 usable acre-feet of storage at Hells Canyon.

Mr. GATCHELL. I believe, Senator, you are reading from table 1 of General Itschner's statement.

Senator NEUBERGER. Table 2.

Mr. GATCHELL. Table 2. You notice that that is taken from House Document 531.

Senator NEUBERGER. That is right.

Mr. GATCHELL. Yes. That is the figure that was in that. We had a hearing before the Federal Power Commission at which a number of the agencies appeared. Mr. Fernald testified. If you will turn to table 1 of General Itschner's statement, Senator, you will see that he has in the column entitled "Storage Used To Control 1894 Flood," he gives for Hells Canyon a figure of 2,600,000 acre-feet. In table 2, to which you directed my attention, there is a figure given as coming from House Document 531, of 3,280,000 acre-feet of usable storage at Hells Canyon.

When the Bureau of Reclamation presented its evidence they accepted the figure which had been presented before which gave the total usable storage as 3,880,000, not all of which, however, was considered as usable for flood control. They reduced the flood control storage to 2,300,000, and that is why the Commission used that figure in its opinion No. 283.

Senator NEUBERGER. Let me ask this to get it straight. The Commission used the figure of 2,300,000 as usable storage flood control. What is the usable storage for flood control of the projects which have been licensed?

Mr. GATCHELL. One million acre-feet.

Senator NEUBERGER. So it is substantially less whether you use the figures in House Document 531 or the figures accepted by the Commission.

Mr. GATCHELL. Yes; it is substantially less.

Senator NEUBERGER. Unless Senator Dworshak or Senator Scott have further questions, we thank you very much for coming with your very useful information. I want to apologize again that you were here so long during the testimony of the engineers, but that took a greater period of time than was expected.

As you know, I am just the acting chairman, so I will put this in the record as the acting chairman: I understand our plans are to resume at 2 o'clock tomorrow afternoon, at which time we will have the Department of the Interior people from the Bureau of Reclamation, the Geological Survey, and the Bonneville Power Administration.

We are in recess until then. Thank you very much.

(Whereupon, at 4 p. m., the committee was recessed, to reconvene at 2 p. m., Wednesday, March 28, 1956.)

UPPER COLUMBIA RIVER DEVELOPMENT

WEDNESDAY, MARCH 28, 1956

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The committee met, pursuant to recess, at 2:20 p. m., in room 412, Senate Office Building, Senator Richard L. Neuberger (Oregon) presiding.

Present: Senator Richard L. Neuberger.

Senator NEUBERGER. We will come to order.

I will say regretfully we are late because of a complete breakdown in communications. I was unaware that the meeting was to be held in this room. I don't know whether the breakdown was on my part or the committee staff or my own staff, but so be it.

Before we hear from the Department witnesses who are, after all, here in Washington, D. C., Mr. James Cellars, who is with the Columbia River Packers Association, from Astoria, Oreg., which is 3,000 miles from here and therefore not quite as accessible, would like, I understand, to make a very brief statement concerning the use of the upper Columbia River for power and storage and other multiple-purpose developments.

Mr. Cellars, would you like to make a very brief and informal statement for the record of the committee?

STATEMENT OF JAMES CELLARS, EXECUTIVE SECRETARY, COLUMBIA RIVER SALMON & TUNA PACKERS ASSOCIATION, ASTORIA, OREG.

Mr. CELLARS. Thank you, Mr. Chairman.

I am James Cellars. I am executive secretary of the Columbia River Salmon & Tuna Packers Association. The members of our association pack approximately 90 percent of the salmon canned and processed in the area of the Columbia River.

This salmon resource produces annual revenue in excess of $17 million, and some 35 million pounds of protein food each year. We are very interested in the early development of all possible power projects and water-storage sites on the upper Columbia River. Our reason is the development of these sites and of storage sites which increases the power potentials of projects already erected on the lower river decreases the pressure for more dams in that area.

We feel that the erection of these dams in the path of the migrations of this anadromous fish is destructive of the resource and for this reason are extremely interested in the earliest possible development of any projects of this type on the upper Columbia River.

In addition, some of our members operate in the Puget Sound in connection with the salmon resource of the Fraser River and apparently at this time the situation on the Fraser River is tangled up with that on the Columbia River. We would like to see an amicable settlement of the differences which exist between the United States and Canada on the developments on the upper Columbia settled as soon as possible.

That is my statement.

Senator NEUBERGER. May I ask you a few questions, Mr. Cellars?

Mr. CELLARS. Yes.

Senator NEUBERGER. I think this is extremely significant to the whole Columbia River development situation. As you point out, the Fraser River, which I imagine is the second greatest salmon river in our whole area, is now involved.

Isn't it your feeling that we should make maximum use of the power resources of the upper Columbia River, because to all intents and purposes, that section of the river is completely eliminated as a factor in the migration of fish?

Mr. CELLARS. The Columbia River system above Chief Joseph Dam is completely eliminated as a factor in the passage or existence of migrating fish.

Senator NEUBERGER. No matter how many dams or how high the dams, there will be no further adverse effect on the salmon and steelhead production of the Columbia River involved?

Mr. CELLARS. That is correct, sir.

Senator NEUBERGER. Doesn't it, then, seem to you incumbent upon our country to make the maximum possible effort to get its power through storage and other facilities on the upper Columbia before any sites are developed which would have a potential or immediate adverse effect on migratory fish?

Mr. CELLARS. That is certainly our position, sir, and we believe it can be established by the facts.

Senator NEUBERGER. A further question. If our relationship with Canada should deteriorate to the extent that Canada felt that their greatest realization from the resources of the upper Columbia would be to divert a substantial portion of that river into the Fraser River system, would that not involve a great threat to the fisheries industry of the Northwest?

Mr. CELLARS. It certainly would, sir. Any diversion of water into the Fraser River system from the Columbia might decidedly have a biological effect on the existence of salmon runs which are in that stream——

Senator NEUBERGER. By that stream you mean the Columbia River?

Mr. CELLARS. The Columbia. And in addition, such a diversion of water to the Fraser River certainly would not be considered without the possibility of erecting power projects on there, which would be extremely damaging to the large salmon resource in that stream.

Senator NEUBERGER. First, you commented in two phases and I would like to ask you about them. The Canadian diversion, as I understand, contemplates about 15 million or 16 million acre-feet of water being diverted between Mica Creek and Revelstoke if it took place; is that correct?

Mr. CELLARS. That is right.

Senator NEUBERGER. Do you think that would have a deleterious impact on salmon on the Columbia River and, if so, for what reason? Would it change the temperature of the water or why?

Mr. CELLARS. It would change the temperature of the water and might at certain times affect streamflows, enabling perhaps an unreasonable take of fish to the destruction of the resource. What I am trying to point out I might illustrate by an example. They were trying to build up the Grand Coulee Dam pool last year. As a result they held water back. During the spring run of salmon on the Columbia River they were holding water back behind Grand Coulee. The river was very low below Grand Coulee. As a result of this low river with a confined passage path for the salmon, the fishery without any, I might say, intention but just because it was there, took what I believe was more than a reasonable amount of the cycle of fish which went up there.

I think that will be a destructive factor in regard to the future recurrence of that run.

Senator NEUBERGER. How about the second part of your comment? If the water were diverted by tunnel into the Fraser, necessarily a project of that magnitude would involve power projects on the upper Fraser. Would that threaten the salmon run on the Fraser River?

Mr. CELLARS. It certainly would, sir. The runs of salmon on the Fraser River are different from those on the Columbia in that they consist of the type of salmon commonly known as sockeye, which breeds in lakes. These lake systems are very high up on the river. It has been proved any delay in the progress of these fish up the river, once they enter it, has extremely bad results on the spawning return. Certainly we have demonstrations that the erection of any project, even if they can pass over it, causes losses. Any delay like that has an extremely bad effect on the spawning results.

Senator NEUBERGER. Another phase of this: The Fraser River is an all-Canadian river. It rises in British Columbia and flows into the sea at New Westminster.

Mr. CELLARS. That is right.

Senator NEUBERGER. Do fishermen in the United States share in that Fraser sockeye run?

Mr. CELLARS. The Fraser sockeye run is regulated by the—I am sorry I don't know the technical name of it. We call it the Sockeye Commission. It is an international commission established by treaty between the United States and Canada. They regulate the fishery, the time of fishery, the method, and some of the gear used. They make every endeavor to have the run or the catch prior to the entrance into the Fraser River divided between the American and Canadian fishermen. They have been very successful in doing that. No matter what the run, the result has been that the American catch and the Canadian catch have been very well divided.

Senator NEUBERGER. So the United States has a direct stake in preventing, if possible, Canadian power developments on the upper Fraser River.

Mr. CELLARS. It certainly has. The return in 1954, for example, was around 10 million sockeye salmon, of which the United States fishermen took approximately 5,500,000, and that represents a lot of value.

Senator NEUBERGER. It certainly does. Mr. Cellars, thank you very much for coming here today and giving us the benefit of your opinions and your information. We are very grateful to you.

Mr. CELLARS. Thank you.

Senator NEUBERGER. I appreciate our other witnesses deferring to Mr. Cellars, who came from a long way off.

Our next witnesses are from the Bonneville Power Administration, Mr. Morgan Dubrow, from the Washington office, and Mr. Henderson McIntyre, who is with the Bonneville Power Administration in Portland, Oreg.

STATEMENT OF MORGAN D. DUBROW, MANAGER, WASHINGTON, D. C., OFFICE OF THE BONNEVILLE POWER ADMINISTRATION, DEPARTMENT OF THE INTERIOR

Mr. DUBROW. Mr. Chairman, I am Morgan Dubrow, manager of the Washington office of the Bonneville Power Administration. I am very pleased to be here this afternoon to testify in response to Chairman Murray's letter of March 15 in which he requests that the Bonneville Power Administration provide current information on the general economic effects of load growth in the Pacific Northwest and its forecast for future power load growth and cost of power at specific sites, particularly as affected by the provision of upstream storage.

I have a prepared statement which I believe covers that request which I would like to present at this time.

Senator NEUBERGER. You may proceed.

Mr. DUBROW. The Bonneville Power Administration does not investigate or develop new project sites. This function is performed by the Corps of Engineers and the Bureau of Reclamation. The Administration, however, would market the power from increased storage and is actively interested in the effect on the power supply of any new project and its economic effect on power rates and payout.

A special interagency committee composed of the Corps of Engineers, United States Army; the Federal Power Commission; the Bureau of Reclamation; the Geological Survey; and the Bonneville Power Administration has been engaged in making special studies relative to the United States-Canadian storage problems with many projects but more specifically with Arrow Lakes and Mica Creek in Canada and the Libby project in the United States and Canada. The amount of storage presently proposed at each of these sites is as follows: Mica Creek, 10,500,000 acre-feet; Arrow Lakes, 3,200,000 acre-feet; and Libby, 5,010,000 acre-feet.

The benefits from these amounts of storage vary with system development and particularly with head development downstream. Based on a system of projects existing or under construction, the above storage projects constructed separately, that is, each added individually to this system would increase capabilities at downstream plants in a critical-year storage release season as follows: Mica Creek, 1,026 average megawatts; Arrow Lakes, 306 average megawatts; and Libby, 630 average megawatts.

I point out with a footnote that Libby at-site generation would amount to 211 average megawatts additional.

By addition of all 3 projects concurrently the total downstream benefit added to the system existing or under construction and under critical-year streamflow conditions would be 1,358 average megawatts. This is 604 average megawatts less than the combined total of the projects each added separately and is due to the lengthening of storage seasons that will occur with completion of all 3 projects. It is illustrative of the effect of increasing storage, particularly cyclical storage.

The increase in generating system costs as a result of these projects has been computed by a modified incremental approach. Under this approach necessary installed capacity at downstream projects is determined both with and without the storage in question on the basis of equal seasonal plant factors at projects where capacity can be varied. The annual cost of each of these capacities is then computed on the basis of prorating all the costs allocated to power at each project among all ultimate generating units for which any provision is made in intial construction. Alternative storage projects can thereby be treated equally insofar as generating costs are concerned. The annual generating costs downstream resulting from addition of each of the three projects individually to the initial base system are estimated under this approach as follows: For Mica Creek the total is $11,120,000, and that is an average annual generating cost per kilowatt of $10.84. For Arrow Lakes the total is $2,660,000, and it gives you an annual generating cost per kilowatt of $8.69. In like manner, Libby is $8,420,000, and $13.37 annually.

I would like to say parenthetically that these costs are only the cost of handling storage water from these projects in existing Federal plants.

The annual generating costs downstream resulting from addition of the 3 projects collectively is estimated in a similar manner at $12,600,000 or $9.28 per kilowatt.

The foregoing figures show energy and cost added by the Canadian storage projects. Critical storage season energy and generating costs added collectively by all the storage projects which were studied are shown by the attached table.

(The table referred to follows:)

EXHIBIT I.—*United States Columbia River power system cost of power at sites particularly affected by upstream storage* [1]

Project	Initial base system				C levels system plus Canadian storage [4]				Increment		
	Prime power (megawatts)	Nameplate rating (megawatts) [2]	Annual power cost [3]	Cost per kilowatt-year	Prime power (megawatts)	Nameplate rating (megawatts) [2]	Annual power cost [2 3]	Cost per kilowatt-year	Prime power (megawatts)	Annual power cost [3]	Cost per kilowatt-year
			Thousands of dollars				*Thousands of dollars*			*Thousands of dollars*	
Grand Coulee	1,261	1,669	$9,760	$7.74	2,012	2,759	$16,770	$8.33	751	$7,010	$9.33
Chief Joseph	715	946	6,060	8.39	1,066	1,503	9,530	8.94	351	3,530	10.06
McNary	540	715	9,170	16.98	707	970	12,445	17.60	167	3,275	19.61
The Dalles	569	753	6,690	11.76	825	1,131	10,055	12.19	256	3,365	13.14
Bonneville	408	518	3,340	8.19	545	518	3,340	6.13	137	0	0
Total	3,493	4,601	34,960	10.01	5,155	6,881	52,140	10.11	1,662	17,180	10.34

[1] Source: Special Inter-Agency Study, United States and Canadian storage projects, Columbia River and Tributaries, January 1955.

[2] Cost for the nameplate installation shown computed on the basis of prorating all the cost allocated to power at each project among all ultimate generating units for which any provision is made in initial construction.

[3] Does not include any cost for storage incremental to the initial base system.

[4] Includes the following storage incremental to the initial base system:

Project	*Usable storage thousands of acre-feet*
Paradise or alternate, Clark Fork River	2,500
Glacier View or alternate, North Fork of Flathead River	1,500
Bruces Eddy, North Fork of Clearwater River	1,433
Penny Cliffs, Clearwater River	2,300
Middle Snake, Snake River	2,300
Mica Creek, Columbia River	10,500
Arrow Lakes, Columbia River	3,025
Libby, Kootenai River	5,010
Total	28,568

Mr. DUBROW. As shown, approximately 28,600,000 acre-feet of storage would add 1,662 megawatts of prime power at an annual generating cost downstream of $17,180,000 or $10.34 per kilowatt. The reservoirs making up this total storage are, of course, not all equally effective as some do not provide water to all the downstream plants which are listed.

Power from such storage projects would be readily absorbed in the normal load growth of customers of the Bonneville Power Administration in the west group area on the Northwest power pool, which includes all of Washington, northern Idaho, western Montana, and nearly all of Oregon. Prime power requirements of this area are expected to increase from 4,100,000 average kilowatts in 1955–56 to 7,100,000 by 1965–66.

Electric power loads have been growing at a rapid rate in the west group area of the Northwest power pool. Loads increased more than sixfold between 1940 and 1954—from 5 billion to nearly 33 billion kilowatt-hours. Much of the stimulus for this load growth was created by the wartime need for strategic materials, particularly aluminum.

(The table referred to follows:)

EXHIBIT II.—*Electric power requirements by major classes of consumers—West group area of Northwest power pool*

[Millions of kilowatt-hours]

Year	Domestic, urban and rural	Commercial and small industrial	Large industrial [1]	Irrigation pumping	Other	Losses	Total annual energy requirement
Actual:							
1940	1,065	881	2,186	22	177	1,029	5,360
1941	1,279	950	3,558	20	190	1,198	7,195
1942	1,552	1,018	5,526	21	246	1,492	9,855
1943	1,830	1,114	8,204	23	427	1,563	13,161
1944	2,007	1,196	9,181	24	564	1,938	14,910
1945	2,304	1,334	7,575	39	602	1,890	13,744
1946	2,780	1,507	6,203	44	552	2,055	13,141
1947	3,409	1,777	8,430	49	554	2,463	16,682
1948	4,144	2,154	9,446	50	523	2,990	19,307
1949	4,834	2,214	9,772	66	480	3,019	20,385
1950	5,469	2,354	11,187	101	500	3,128	22,739
1951	5,940	2,499	12,672	369	505	3,630	25,615
1952	6,722	2,686	[2] 12,601	391	563	3,268	26,231
1953	7,272	2,827	15,182	473	541	3,801	30,096
1954	8,284	3,247	16,081	778	538	4,137	33,065
Estimated:							
1955	9,197	3,147	18,362	832	572	4,587	36,697
1956	10,272	3,376	21,326	879	609	5,212	41,674
1957	11,388	3,613	23,554	975	626	5,389	45,545
1958	12,546	3,876	24,093	1,098	638	5,651	47,902
1959	13,743	4,148	24,441	1,168	649	5,983	50,132
1960	14,988	4,446	24,801	1,283	660	6,097	52,275
1961	16,277	4,756	25,173	1,373	671	6,290	54,540
1962	17,472	5,096	25,557	1,474	683	6,669	56,951
1963	18,707	5,466	25,953	1,582	695	7,107	59,510
1964	19,986	5,850	26,518	1,689	707	7,466	62,216
1965	21,309	6,266	27,194	1,802	719	7,812	65,102

[1] Exclusive of any new large electroprocess plants after 1957.
[2] Decrease from previous year due to curtailment of large industrial loads and other voluntary curtailment.

Mr. DUBROW. With this expansion in industry, Pacific Northwest population by 1954 had increased about 42 percent over 1940. As a result of population growth and almost complete urban and rural electrification, the number of domestic customers in the region grew from less than 700,000 in 1940 to more than 1,200,000 in 1954.

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In 1954 the average domestic consumer in the area used 6,600 kilowatt-hours, compared with only 1,600 kilowatt-hours in 1940. Saturation of appliances is high. Reports of the major utilities in the region indicate that approximately three-fourths of their domestic customers own electric ranges and about two-thirds have electric hot water heaters. Because of the concurrent expansion in both number of customers and use per customer, electric energy requirements for domestic purposes increased from 1.1 billion in 1940 to 8.2 billion kilowatt-hours in 1954.

The current load estimates of the electric power distributors serving the area forecast a load growth from 37 billion kilowatt-hours in 1955 to 65 billion in 1965 or about a 6 percent annual rate of growth. These estimates are conservative in that they include no new electroprocess loads beyond the few announced expansions of existing companies. However, many such new loads will be served. Large blocks of power will be made available for heavy industrial expansion upon the completion of certain hydroelectric projects which are presently under active consideration by distributors in the area. If the region's hydroelectric potential is developed fast enough to insure an adequate power supply, load growth will exceed the estimate, and the estimated rate of growth will increase from 6 to about 10 percent annually.

Senator NEUBERGER. Thank you very much, Mr. Dubrow.

I want to ask you just a very few questions. You gave the costs on page 3 per kilowatt. Sometimes you have to explain a little to us laymen. Does that compare with the present rate of $17.50 a kilowatt-year?

Mr. DUBROW. Yes. That is the annual per kilowatt cost.

Senator NEUBERGER. In other words, the present Bonneville wholesale is $17.50 a kilowatt-year.

Mr. DUBROW. That is right.

Senator NEUBERGER. The cost of additional facilities required to generate additional power made possible by Mica Creek would be $10.84.

Mr. DUBROW. The actual cost of the facilities which either are in place or would have to be provided at the rates that the costs were when these projects were built would be $10.84.

Senator NEUBERGER. In other words, what you mean is this——

Mr. DUBROW. Mr. McIntyre points out, of prime power. That is what we are talking about.

Senator NEUBERGER. What you mean is this, then: Let's just forget the storage dam has made it possible at the moment. The cost of installing additional generators, additional powerhouse space, and so on, and producing that power at the site which is made possible by the increased stream flow in the Columbia River would be $10.84 as a result of Mica Creek. Is that correct or incorrect?

Mr. DUBROW. I think, Senator, it is substantially correct, except that in this $10.84 figure are costs which have occurred over a period of years when we have had a rising cost index.

Senator NEUBERGER. You are quibbling about it. I am trying to get some information on this point. I want to see if between what it would cost to install this generating capacity at the dams downstream to turn out this additional power and the present Bonneville rate of $17.50 a kilowatt-year there is a substantial slack which would

make it possible for the United States to pay downstream benefits to the Canadians which would warrant them putting in that storage. That is what I am trying to get from you, if you follow me.

Mr. DUBROW. I am not trying to quibble or hedge the question. I do want to say that this $10.84 represents the actual cost of generating the power from water which would be stored at, say, Mica Creek and in the project that we now have there which we have already paid for. In addition to that there would be a transmission cost to get that power to market. So that cost is not reflected in this figure.

Senator NEUBERGER. How much would that be?

Mr. DUBROW. That would be roughly $7.50 to $8.50 a kilowatt-year.

Senator NEUBERGER. Then there isn't any slack in this to pay downstream benefits to Canada and still maintain the present rate. This is a $64 question. Mr. McIntyre, nobody is under oath here. Maybe you can take part in this. Come on up here.

Mr. DUBROW. I am not trying to hedge, but I want to make it clear to you that the way these figures are set out you can't make that kind of analogy just from looking at these figures.

Senator NEUBERGER. Can I do it by talking to you, because this is a very important thing.

Mr. DUBROW. Yes.

Senator NEUBERGER. The whole key to the development of the Columbia River it seems to me from now on is, will the Canadians think it is more to their advantage to divert a portion of the Columbia into the Fraser or to build those storage dams on the upper Columbia to share the value and the benefits with us and receive some payment from us? We in the Congress, if we are to have anything at all to do with this, have to have some information to go on. Again, this is what I am trying to get at.

It is obvious that if Mica Creek or Arrow Lakes or any of these storage projects on the upper Columbia are built, we are going to have to reimburse the Canadians for the storage which is released to increase our power production downstream, to say nothing of flood control.

Mr. DUBROW. Certainly there will have to be some kind of equitable arrangement as between the two countries in order to do this. That is right.

Senator NEUBERGER. I am trying to find out how much difference there will be in the cost of producing this additional power, let's say at McNary or Bonneville or Chief Joseph and $17.50 per kilowatt-year. Do you follow me or not?

Mr. MCINTYRE. The problem is that we really don't have any exact cost figures on the Canadian storage projects themselves, and in any attempt to allocate power between the Canadian projects or any storage projects downstream in accordance with costs, I think the cost would have to be somewhat higher than our present rate.

Senator NEUBERGER. Let's go on and ask a few more things.

Mr. DUBROW. Senator, if you will look at exhibit 1——

Senator NEUBERGER. I was looking at exhibit 1.

Mr. DUBROW. You see these costs in the initial base system range from $7.74 at Grand Coulee to $16.98 at McNary. This $10.34 figure is simply the share of the cost of the existing projects which would be allocated to water storage at Mica Creek, if you put it in there

purely on the ratio of the percentage of power you are getting from that storage as contrasted with some storage that we already have.

Senator NEUBERGER. That is what I mean. That gives me some more information. Let me ask you this: Is this $10.84 at Mica Creek storage comparable with the $8.39 at Chief Joseph and $16.98 at McNary?

Mr. DUBROW. Yes.

Senator NEUBERGER. Those figures are comparable.

Mr. DUBROW. Yes, that is right.

Senator NEUBERGER. Does that mean, then, that we could pay some fairly substantial downstream benefits to Canada and be within the framework of $17.50 a kilowatt-year if McNary can be within the framework of $17.50 a kilowatt-year?

Mr. MCINTYRE. We have been studying that for quite some time and it is a very complex study. We have tried to work it out on a very great many formulas but we have not come to any final conclusion on that.

As you know, the cost of hydro is going up, and it probably will be some higher, but I don't know just how much. I don't think it will be too much higher than our present rate.

Senator NEUBERGER. You mean what this would be or what hydro in general would be?

Mr. MCINTYRE. This would be, or hydro in general, either.

Mr. DUBROW. Senator, if I may add something to that, the thing that makes the Canadian storage particularly valuable at this particular juncture in time is that we have this huge investment in projects which have actually been constructed by the United States. What we have done here is to try to reflect what proportion of those actual costs storage from Canada should be allocated.

Mr. MILTON C. MAPES. I think what he is saying, perhaps, Mr. Chairman, is the fact that all of this $10.84 for downstream generation from Mica Creek would not be additional expenditure in the future.

Mr. DUBROW. That is right.

Mr. MAPES. Much of that is already in the downstream dam.

Mr. DUBROW. Yes.

Senator NEUBERGER. I understand that you don't have to put in the superstructure and so on. You have to add generating equipment.

The other day this question was asked of General Itschner and Mr. Fernald: Assuming there was no boundary and no international complications, which projects or project would you think should be the next ones built in sequence in the Columbia Basin? What would your answer be to that?

Mr. DUBROW. My answer would certainly be from the power point of view that we could get more power from a Federal project such as Libby than from any other. However, it must be said that a project such as Arrow Lakes, which could be built in a shorter period of time, would put power on the line quicker than the other, but Libby or Mica Creek would certainly provide more power ultimately, as is indicated on page 2.

Senator NEUBERGER. Have you people conveyed your opinions to the International Joint Commission in this respect?

Mr. DUBROW. As General Itschner pointed out, I believe, we have tried to keep the IJC informed of the work that we have been doing

cooperatively as between the several Government agencies working on this problem.

Senator NEUBERGER. The reason I am asking these questions is this, which is basic to the whole relationship with Canada and the use of the Columbia Basin. Under this so-called C schedule, the Canadian storage is very valuable to us if it is built immediately. It is less valuable, I understand, if other projects have been constructed in the interval, such as on the Clearwater, Glacier View, and so on. Is that correct or incorrect?

Mr. DUBROW. I think that is true.

Senator NEUBERGER. This is the thing I encountered when I was in Canada last October. On May 10, 1955, Governor Jordan, Chairman of the International Joint Commission, made a speech in Canada in which, in my opinion, he minimized the benefit to us of Canadian storage, because he made the assumption that a great many other projects would have been added in the United States before Canadian storage would be built. For example, he mentioned Bruces Eddy and Penny Cliffs. He said—

Claims have been made that the Mica Creek project, for example, would increase prime power output in the United States by approximately 1,100,000 kilowatts—

Et cetera.

The conditions and assumptions which are necessary to support such a figure are unrealistic and it is a gross overstatement of the true value of the project to the United States.

At the end of his statement he said—

Storage projects in Canada will no longer afford a large advantage to the United States.

The thing I am still trying to find out, I tried to find out from the Army engineers and am asking you: What does he base the assumption on that he minimized to the Canadians the value of Canadian storage? On what does he base the assumption that these other projects will necessarily be built in the interval? Has he been advised by Bonneville? Has he been advised by the engineers? Has he been advised by anyone?

Mr. DUBROW. I am certain, Senator, that he has had the benefit of the interim report which was prepared by all the Federal water resource agencies out there, and on the basis of the assumptons set out in that report I think it must be said that, with time and over the pay-out period of the 50 years with which we are concerned on any one of these projects, the value of Canadian storage does become less to the United States as other storage such as Libby or the Clearwater plant is added to the system.

Senator NEUBERGER. Libby is Canadian and this involves the payment of downstream benefits.

Mr. DUBROW. Let me put it this way: To the extent that sizable blocks of American storage are brought in, it does reduce somewhat the value to us of the Canadian storage, but that is not to say that it would not always have some real value to us.

Senator NEUBERGER. This is the thing that bothers me: We have to have more power in the Northwest. All right, let's look at the schedule. In your exhibit No. 1 let's go down these sites one by one.

The first one is Paradise or alternate. That is the first one on your list, isn't it?

Mr. DUBROW. Yes; that is right.

Senator NEUBERGER. We are talking about the American sites. Paradise or alternate. Am I right or wrong in presuming that the Montana Power Co. has filed on a Buffalo Rapids alternative site which is in the Paradise reservoir area? Is that right or wrong?

Mr. DUBROW. That is my understanding; yes, sir.

Senator NEUBERGER. That is a situation, then, which is to a very substantial degree comparable to Hells Canyon where the high dam has been ruled out because the private power company filed on the sites in that same reach of the Snake River.

Mr. DUBROW. That is certainly a situation wherein there is a controversy.

Senator NEUBERGER. There is a controversy all right. I am not asking you to comment on what should be done. I would not want to involve you, because I know you wouldn't want to pass on it.

Second, you have Glacier View. That is a site in the national parks, which involves almost identically the same conflict which involved Echo Park site, which held up the upper Colorado bill for many years and now has been eliminated.

There is no doubt about the facts on that. I am not asking you which is right or wrong. That is the fact.

Mr. DUBROW. That is right.

Senator NEUBERGER. Then you come to Bruces Eddy and Penny Cliffs. You have nearly all the large outdoor groups here in Washington opposed to Bruces Eddy and Penny Cliffs. You have the National Wildlife Federation, the Wildlife Management Institute, the Audubon Society, the National Park Association, the Wilderness Society—all these groups opposing projects because of the impact on steelhead runs, and so on.

Then you have the Middle Snake, which is certainly in controversy over the Hells Canyon situation.

Mr. DUBROW. Yes.

Senator NEUBERGER. The thing which concerns me is that all these so-called C schedule places, which the head of our International Joint Commission cited to the Canadians as minimizing the value of Canadian storage, are in heavy controversy. The thing I am afraid of from talking to the Canadians is that they have been given the impression already by Governor Jordan that their storage would have no value to us, and if it is accentuated, if it is at all possible engineeringwise, they will divert. That is what I would like to see prevented.

When we tell them that because we are going to build these other projects in the United States, Canadian storage, in the words of the head of the International Joint Commission, "Will no longer afford a large advantage to the United States," it seems to me that is an open invitation to them to go ahead and divert.

I am just trying to find out who has told Governor Jordan that we can safely assume that all these C schedule projects are going to be built ahead of the possibility of Canadian storage.

Mr. DUBROW. Senator, I will only comment as follows: As you know, Bonneville's responsibility is to market the power from Federal projects which are built in the Northwest. We are not planning projects except as an aid to the Corps of Engineers and the Bureau of

Reclamation in making the power studies and laying out the transmission facilities which they need for them. When we are asked to prepare actual cost data, we have to tie it into something, and we usually start with the C system or some system which we are working toward, in order to get a common denominator so we can give you some relatively correct values for costs.

Senator NEUBERGER. Maybe we ought to hear Mr. McIntyre's statement. I know he has one here which he has prepared. You will agree that it is not a safe assumption, in view of all the controversies I have mentioned, to presume that the C schedule projects will be built in the very near future.

Mr. DURBOW. I think that is undoubtedly correct. I would go further to say, as I have said, that because the Canadian storage diminishes in value, particularly the cyclical storage, that is not to say that it is not important and would not always be of some real importance to us.

Senator NEUBERGER. Thank you. Do you want to present your statement now, Mr. McIntyre?

STATEMENT OF HENDERSON M. McINTYRE, HYDRAULIC OPERATIONS OFFICER, BONNEVILLE POWER ADMINISTRATION, PORTLAND, OREG.

Mr. MCINTYRE. My name is Henderson M. McIntyre. I am Hydraulic Operations Officer of the Bonneville Power Administration. I would like to say before I read my statement that I am happy to appear before the committee.

Senator NEUBERGER. We are glad to have you.

Mr. MCINTYRE. My statement is in response to a letter written to Dr. Pearl from the permanent chairman of the committee, Senator Murray, I believe. I believe the statement covers the questions that he asked.

The problem of relating large storage developments to the future development of thermal or atomic electric generating plants in the Northwest is very complex. The principal problem is to ascertain the time and rate at which energy from storage will decrease in value. Present indications are that the value of storage will not decline at a rapid rate. This matter is under continual study by individual engineers and Federal agencies but final conclusions are not available. This will also be one phase of the present Corps of Engineers Review Report of House Document 531.

There are approximately 57 projects in the Pacific Northwest area, including Canada, currently under construction and active consideration, in addition to projects of the United States Columbia River system. They will add approximately 24,591,000 acre-feet of storage and 8,954,000 kilowatts of nameplate rating. According to a recent load estimate for the Pacific Northwest area, the construction of all these projects would make possible service to area firm loads from hydroelectric resources to somewhere between 1970 and 1975. After that time load requirements would have to be served from either conventional steam-electric plants or atomic electric-generating facilities, or marginal hydroelectric plants. At the present time almost the entire load is served by hydroelectric generating plants, excluding the Utah Power & Light Co. system.

Most of the steam-generating plants which are available are relatively small and high cost. Many of them are obsolete. The production cost increment for these steam plants averages approximately 7½ mills per kilowatt-hour, and this source of energy is used primarily for emergencies or during critical hydroelectric conditions.

Attached are two curves entitled "Pacific Northwest Long Range Outlook for Energy Load and Firm Energy Resources" and "Electric Generation Costs, Pacific Northwest." On the first curve the top line represents the energy load of Oregon, Washington, Idaho, and western Montana, except area served by COPCO and Utah Power & Light Co., and is a preliminary estimate of the Federal Power Commission. The various bands below this top curve indicate the various sources of energy that are needed to meet the estimated load. The first area at the bottom represents the present United States Columbia River power system and all projects currently under construction. The next band is the non-Federal and miscellaneous hydroelectric projects existing and under construction. The next small area at the left of the chart is the energy from existing thermal-electric plants which you will note dwindles to nothing about the year 1975. It is believed that these projects will have been replaced at that time.

The next area is the incremental energy from new hydroelectric generation added above those under construction, either Federal or non-Federal. You will note that there is a continuing increase in generation through the year 2000, due to the addition of marginal hydroplants after 1975. The area also reflects incremental energy changes due to changes in operation with the addition of conventional and nuclear steam-electric plants.

The next bands, which are crosshatched, are a conjecture as to the relative proportions of nuclear and conventional steam-electric energy which may be used to meet the remaining load.

From an economic standpoint hydroelectric development should be continued as long as the incremental cost of additional hydro is less than the incremental cost of thermal generation. Present predictions in cost studies indicate that the crossover will occur somewhere between 1970 and 1975 as illustrated by the second chart. However, due to conflicts of interest, such as migratory fish and navigation, it may be necessary to start installing base-load steam generation by 1970 or before. Some steam-electric plants should be in operation before 1970 for hydro firming purposes.

The estimates of thermal-electric generation costs are based on long-range predictions. Conventional fuels in the Northwest will probably range between 30 to 40 cents per million British thermal units during the next 15 to 20 years, and net heat rates will be substantially improved. The resulting total generation costs at system load factors and Federal cost ratios should then range from 4.2 to 5.2 mills per kilowatt-hour. By 1975 several generations of nuclear power reactors will have been constructed, and it is estimated that total generation costs by this means, at Federal cost ratios, will then be approximately 4.5 mills per kilowatt-hour.

Since the Pacific Northwest does not have large reserves of oil or gas and the coal reserves are relatively low quality, fuel cost for conventional steam-electric plants will be high. The coal reserve in

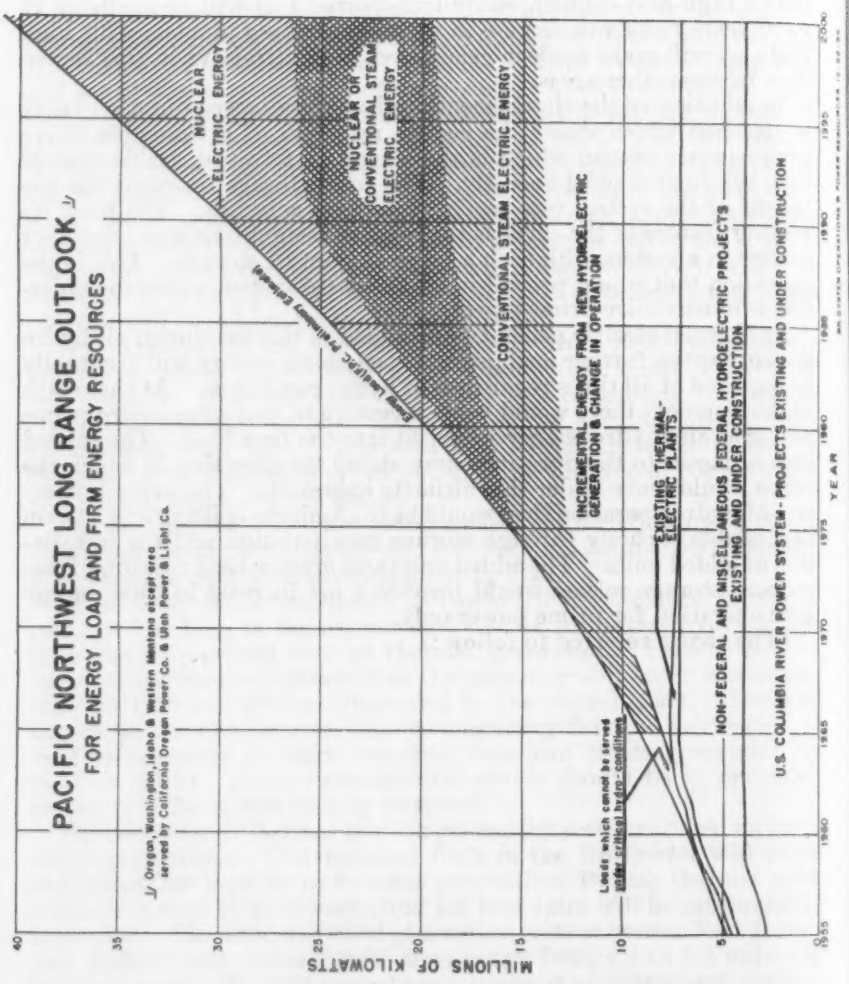
western Washington is relatively small, and from a survey made in 1952 cost estimates by mine operators indicated fuel costs averaging approximately 30 cents per million British thermal units for a steam plant near the coalfields.

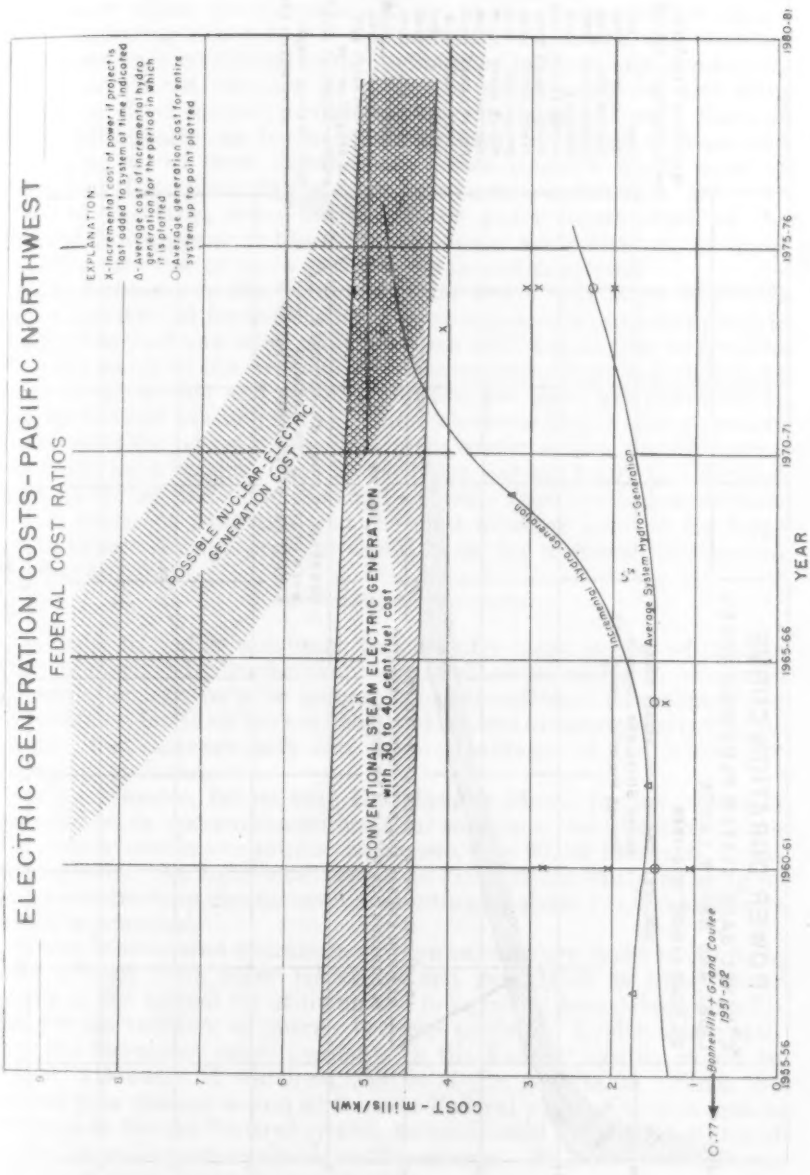
Oil in small quantities for use in steam plants in the Portland area costs 36 cents per million British thermal units at present. Although this cost would be reduced for large quantity deliveries, it is doubtful if this high-heat-content, easily transported fuel will be available 25 to 50 years from now for use in steam generating plants. This high fuel cost will make nuclear generation more attractive in this region than in some other areas.

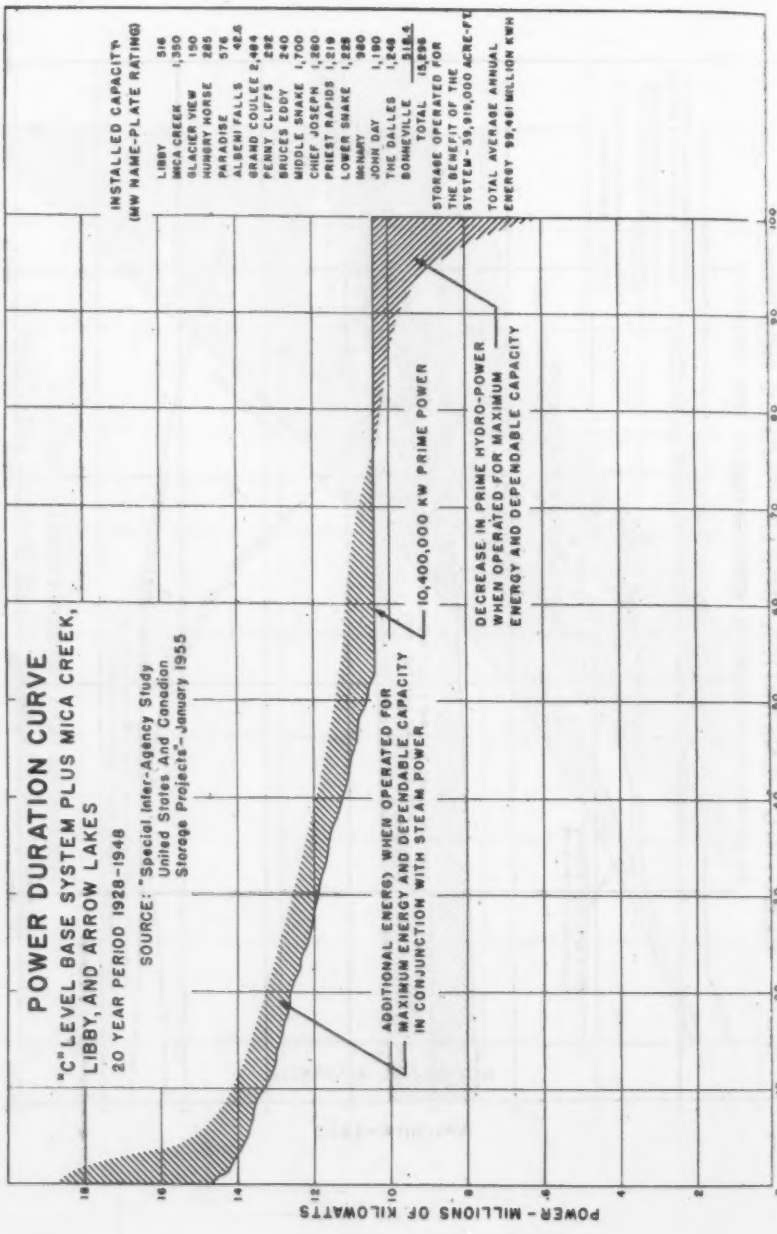
In addition to the charts mentioned above a power duration curve is attached which shows the energy resources of a Columbia River hydroelectric system which is the largest in terms of usable storage that has been studied recently. The total storage operated for the benefit of the system was nearly 40 million acre-feet. The most revealing feature of the curve is the relative insignificance of secondary energy in a system with such a large amount of storage. This is the operation that would prevail in an all-hydro system where the objective is to maximize prime power.

As thermal-electric generation is added to this maximum all-hydro system to meet further load growth, some steam energy will eventually be required at all times regardless of hydro conditions. At that stage of development there would be no incentive to maximize hydro prime power as any hydro energy would fit into the firm load. The shaded area adjacent to the duration curve shows the direction in which the curve would move under this ultimate operation. The overall objective of hydro operation then would be to eliminate spilling and sustain dependable capacity through storage manipulation and the installation of added units. The added units and greater head resulting from reduced storage release would provide a net increase in total energy over operation for prime power only.

(The charts referred to follow:)


PACIFIC NORTHWEST LONG RANGE OUTLOOK 1/
FOR ENERGY LOAD AND FIRM ENERGY RESOURCES
1/ Oregon, Washington, Idaho & Western Montana except area served by California Oregon Power Co. & Utah Power & Light Co.
NUCLEAR ELECTRIC ENERGY
NUCLEAR OR CONVENTIONAL STEAM ELECTRIC ENERGY
CONVENTIONAL STEAM ELECTRIC ENERGY
INCREMENTAL ENERGY FROM NEW HYDROELECTRIC GENERATION & CHANGE IN OPERATION
EXISTING THERMAL-ELECTRIC PLANTS
NON-FEDERAL AND MISCELLANEOUS FEDERAL HYDROELECTRIC PROJECTS EXISTING AND UNDER CONSTRUCTION
U.S. COLUMBIA RIVER POWER SYSTEM - PROJECTS EXISTING AND UNDER CONSTRUCTION
Loads which cannot be served under critical hydro conditions
MILLIONS OF KILOWATTS
YEAR
40
35
30
25
20
15
10
5
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000


ELECTRIC GENERATION COSTS - PACIFIC NORTHWEST
FEDERAL COST RATIOS
EXPLANATION
X-Incremental cost of power if project is last added to system at time indicated
Δ-Average cost of incremental hydro generation for the period in which it is plotted
○-Average generation cost for entire system up to point plotted
POSSIBLE NUCLEAR-ELECTRIC GENERATION COST
CONVENTIONAL STEAM ELECTRIC GENERATION with 30 to 40 cent fuel cost
Incremental Hydro-Generation
Average System Hydro-Generation
Bonneville + Grand Coulee 1951-52
0.77
COST - mills/kwh
YEAR
1955-56
1960-61
1965-66
1970-71
1975-76
1980-81


POWER DURATION CURVE
"C" LEVEL BASE SYSTEM PLUS MICA CREEK, LIBBY, AND ARROW LAKES
20 YEAR PERIOD 1928-1948
SOURCE: "Special Inter-Agency Study United States And Canadian Storage Projects"-January 1955
INSTALLED CAPACITY (MW NAME-PLATE RATING)
LIBBY 516
MICA CREEK 1,350
GLACIER VIEW 150
HUNGRY HORSE 285
PARADISE 576
ALBENI FALLS 42.6
GRAND COULEE 2,494
PERRY CLIFFS 292
BRUCES EDDY 240
MIDDLE SNAKE 1,700
CHIEF JOSEPH 1,280
PRIEST RAPIDS 1,219
LOWER SNAKE 1,228
McNARY 980
JOHN DAY 1,190
THE DALLES 1,240
BONNEVILLE 518.4
TOTAL 18,290
STORAGE OPERATED FOR THE BENEFIT OF THE SYSTEM - 35,918,000 ACRE-FT
TOTAL AVERAGE ANNUAL ENERGY 99,481 MILLION KWH
ADDITIONAL ENERGY WHEN OPERATED FOR MAXIMUM ENERGY AND DEPENDABLE CAPACITY IN CONJUNCTION WITH STEAM POWER
10,400,000 KW PRIME POWER
DECREASE IN PRIME HYDRO-POWER WHEN OPERATED FOR MAXIMUM ENERGY AND DEPENDABLE CAPACITY
POWER - MILLIONS OF KILOWATTS
PERCENT OF TIME

REGIONAL DEVELOPMENT

Mr. McINTYRE. The comprehensive development of any river system is a very complex matter. This is particularly true of the Pacific Northwest where the Columbia River Basin covers 259,000 square miles, including about 39,000 square miles in Canada, and weather conditions vary considerably throughout the basin at any given time.

Any plan must consider all phases of water resources, including irrigation, flood control, navigation, recreation, and power. Each of these individually can be developed by many alternate methods and combining all of them together can create conflicts which must be reconciled if complete development is to be accomplished.

All of the large dams constructed or under construction by the Federal Government in the Columbia Basin are multipurpose dams providing for two or more of the above-named functions.

It is fortunate in the Columbia River Basin that large reservoirs can be constructed for increasing the power potential and also provide for flood control and other multipurposes with a minimum of conflict. This is a result of the streamflow characteristics where the high flows occur in the spring and summer and the low flows are prevalent in the late fall and winter months. Under these conditions storage waters are released for power production in the winter season, and by spring reservoirs have reached their lowest point and are ready to recapture the high spring and summer runoff reducing flood levels downstream.

It is apparent from this that the most effective location for large multipurpose storage projects would be as far upstream as physical limitations permit.

COORDINATED OPERATIONS

In order to realize maximum benefits of a large system of storage and run-of-river hydroelectric projects full coordination is necessary. Coordination can only be accomplished if sufficient interconnecting transmission facilities are available and control of operations is flexible enough that management can take advantage of the constantly changing conditions.

As an example, let us take the Hungry Horse project where if operated on an uncoordinated basis for serving a local load requiring a maximum continuous production at-site, only 90,000 kilowatts would be available. An incidental benefit to projects currently existing or under construction downstream amounting to about 121,000 kilowatts would be provided.

Under coordinated operation, storage releases are made to conform with releases from other reservoirs and generation at run-of-river plants in the system by utilizing the integrating transmission facilities for the transfer of energy between projects. Under this condition the increment made available to the Federal system would be 600,000 kilowatts of which 212,000 is at-site generation. Since the critical year storage season of the non-Federal projects in this area is the same as for the Federal system, an additional 247,000 kilowatts of prime energy is made available at these plants. This is a good example of what happens through coordination.

In determining the prime benefit a project adds to a system the critical low streamflow period is used. In order to accomplish coordinated operation under actual operating conditions a continuing supply of

hydrologic, meteorologic, and load information must be assembled each day so that management can adjust the various reservoirs in the system in accordance with these ever-changing load and streamflow conditions.

Senator NEUBERGER. Thank you, Mr. McIntyre.

Just one or two brief questions.

What do you think is the best way to add power production in the Northwest and at the same time to hold the rate down? Do you have any preference as to what projects should be added?

Mr. MCINTYRE. No, I really don't. I have not made a study like that myself. I have worked on what these different projects will add in the way of kilowatts, but I have not made a specific study as to what the cost effects would be on the system.

Senator NEUBERGER. You referred over here to adding steam power at around 4.2 to 5 mills; something like that.

Mr. MCINTYRE. Yes.

Senator NEUBERGER. I don't have the information you engineers have, so you will have to bear with me. The present Bonneville industrial rate is 2.2 mills; is that right?

Mr. MCINTYRE. That is about right; yes, sir.

Senator NEUBERGER. I read in the New York Times business section some weeks ago that the Kaiser Co. could obtain power at steam plants on the Ohio River using barge transportation for coal at a little over 4 mills a kilowatt-hour. Would that seem about right from your knowledge of steam production?

Mr. MCINTYRE. That seems about right; yes, sir.

Senator NEUBERGER. When we consider the Pacific Northwest is 2,000 miles from the center of distribution and consumption of goods in this country, unless we keep a rate of around 2.2 mills or only slightly over it, that region will not attract large users of power for industrial purposes, will it?

Mr. MCINTYRE. I don't know just exactly what the range is, but if it gets too high that is true.

Senator NEUBERGER. What projects could best be added to most nearly maintain our 2.2-mill industrial rate?

Mr. MCINTYRE. I am not prepared to answer that question. I can try to get the information for you and insert it in the record later.

(The information referred to is as follows:)

In examining our records I find that we have never undertaken a study to determine what new multipurpose projects could be added to the present Federal Columbia River system and still maintain the present BPA rate levels. A study to determine what effect new projects would have on BPA rate levels would require a considerable period of time and be of more value if attempted after completion of the Corps of Engineers current review of House Document 531.

Senator NEUBERGER. That would be very helpful. As I see it, what we need in the Northwest is not power, but low-cost power. We could get power from windmills and candles and everything else, but it would not be low-cost power. From all the reading and information that I have been able to get, this fact pertains. In view of the high freight rates for shipping across the country and the differential across the Rockies, unless the power rate is much lower in the Northwest than anywhere else we will not have large-scale industrial users. Mr. Dubrow had some very interesting figures about consumption of power in the region, but actually if we did not have

these large industrial users we might even have a surplus of power; isn't that correct?

Mr. McINTYRE. I believe that is right.

Mr. DUBROW. I think that is correct.

Senator NEUBERGER. We don't have a power shortage except low-cost power for industrial uses.

Mr. DUBROW. I believe that is correct.

Senator NEUBERGER. The thing I think is so important is how could we best add low-cost power to the Bonneville system? Could we do that through encouraging our Canadian friends and neighbors to build these projects and then reimburse them through downstream benefits or through some of these thermal additions which have been discussed? Which is the cheapest power?

Mr. McINTYRE. Undoubtedly in the immediate future it would be by the addition of upstream storage. As the system expands and you get into the higher cost hydroelectric plants, then you would be in competition with the thermal-generating plants.

Senator NEUBERGER. When you say higher-cost hydroelectric plants to which ones do you have reference?

Mr. McINTYRE. I don't have a list of how these projects increase in value individually, but in building up the material in this second chart we got the cost of these projects from whatever information was available and built up the curve to the point that they became almost equivalent. I don't know just what order that was. I can also supply that information.

Senator NEUBERGER. Will you supply that for the record, because it must be available. I can remember Mr. Ostrander—is that the correct name?

Mr. DUBROW. Yes.

Senator NEUBERGER. I can remember Mr. Ostrander testifying during the Hells Canyon hearings that Hells Canyon high dam could be added—perhaps I should say could have been added, alas—without increasing the $17.50 kilowatt-year rate. So there must be studies for all these potential sites. If we could get that, I would appreciate it.

Mr. McINTYRE. I will get that information for you the way we worked up this chart. I would like to state, however, that some of the information was very meager and may change with additional investigation, particularly for some of the potential projects which have not had a lot of study.

(The information requested is included in the following letter to Senator Murray from Mr. McIntyre:)

APRIL 10, 1956.

Hon. JAMES E. MURRAY,
Chairman, Senate Committee on Interior and Insular Affairs,
Senate Office Building, Washington, D. C.

MY DEAR SENATOR MURRAY: On March 28, 1956, I appeared before your committee as a representative of the Bonneville Power Administration. In the course of my testimony I was requested by the Honorable Senator Neuberger to supply certain additional information. Accordingly, the following material is submitted:

Request: What projects could best be added to most nearly maintain our 2.2-mill industrial rate?

In examining our records I find that we have never undertaken a study to determine what new multipurpose projects could be added to the present Federal Columbia River system and still maintain the present BPA rate levels. A

study to determine what effect new projects would have on BPA rate levels would require a considerable period of time and be of more value if attempted after completion of the Corps of Engineers current review of House Document No. 531.

Request: When you say higher cost hydroelectric plants to which ones do you refer?

I believe that this request had reference to the curves on chart No. 91602, Electric Generation and Cost Ratios—Pacific Northwest, which show in a very approximate manner the comparative cost of hydroelectric, thermal-electric, and nuclear-electric power with respect to time. Many of the proposed projects have had only a cursory review and cost estimates are very preliminary. We have therefore shown these projects by groups in tables 1 and 2 attached. These groups contain both Federal and non-Federal proposals. Additional explanatory material is as follows:

All costs are given in mills per kilowatt-hour of salable energy at plant. For comparative purposes only, costs are computed on the basis of Federal financing with amortization over 50 years at 2½ percent interest. Method of financing many of the future plants cannot be predicted at present. Transmission costs are excluded as it was desired to compare sources of generation only.

The curve for average Federal system hydrogeneration shows unit costs increasing from about three-fourths of a mill in 1951–52 to 1½ mills over the period 1961 to 1965 and then to about 2¼ mills by 1974–75. This curve was drawn from the four points shown by column 6 of table 1. Costs for the United States Columbia River power system for 1945–55 and 1960–61 are taken from our rate adjustment study of September 1955 and reflect many refinements which were not possible to consider for the future projects included in the years 1964–65 and 1974–75. Annual cost of the future projects were based on cost estimates for operation, maintenance, and major replacements, where available. Many of the future projects had only an estimate of capital cost and an annual cost factor of 5 percent was assumed to cover interest at 2.5 percent, amortization over 50 years, operation, maintenance, and replacements.

The curve for incremental hydrogeneration shows costs of about 1¾ mills for a few years subsequent to 1955, then a slight reduction followed by an abrupt rise to nearly 5 mills by 1975. The curve was sketched through the incremental costs shown by column 7 of table 1. As each of these increments covers a lengthy period, the curve provides only a rough approximation of incremental costs in any one year. Actual yearly incremental costs will undoubtedly vary widely. This is illustrated by the costs plotted for certain selected projects, which vary from slightly over 1 mill to more than 5 mills. Each point is computed on the basis of addition of the project to the system otherwise existing at that date. Different incremental costs would result from addition of these projects at a different system. The incremental costs shown for storage projects include the cost for necessary additional downstream generating facilities, while costs for all projects exclude any allocation to previously existing upstream storage.

It is apparent from the analysis that most new hydroelectric projects will be built at higher costs than those presently in operation. The addition of new higher cost projects to the Federal system, however, would be offset by the large backlog of lower cost projects presently in operation. At some point the addition of new federally constructed projects would require an increase in BPA rate levels. The time that this would occur is dependent upon unpredictable factors such as the projects to be added, sequence of additions, price levels, and others.

I hope that this letter supplies the information your committee desires.

Sincerely yours,

H. M. McINTYRE,
Hydraulic Operations Officer.

TABLE 1.—*Hydroelectric capabilities and costs, United States Columbia River power system plus selected future projects* [1]

Operating year [1]	Annual generation cost		Salable energy		Cost per kilowatt-hour	
	Total [2]	Incremental	Total [3]	Incremental	Total	Incremental
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Thousands of dollars	*Thousands of dollars*	*Megawatts*	*Megawatts*	*Mills*	*Mills*
1954–55	29,048	32,655	2,655	2,136	1.25	1.75
1960–61	61,703	20,192	4,791	1,477	1.47	1.56
1964–65	81,895	141,963	6,268	4,983	1.49	3.25
1974–75	223,858		11,251		2.27	

[1] See table 2 for projects operating each year.
[2] Cost of existing United States Columbia River system plus cost of major new projects estimated on basis of Federal financing.
[3] 1954–55, actual generation; 1960–61, median-month storage season energy capability; 1964–65, median-month storage season energy capability; 1974–75, prime power capability.

Source: Bonneville Power Administration, Branch of System Operations and Power Resources, Apr. 10, 1956.

TABLE 2.—*Projects included in cost of power estimates—United States Columbia River power system plus selected future projects*

1954–55 system:
- Bonneville
- Grand Coulee
- Hungry Horse
- Detroit
- Big Cliff
- Lookout Point
- Dexter
- McNary, 7 units
- Albeni Falls, 1 unit

Added in period 1955–56 to 1960–61:
- McNary, 7 units
- Albeni Falls, 2 units
- Chief Joseph
- Chandler
- The Dalles
- Mayfield
- Noxon Rapids
- Rosa
- Cougar

Added in period 1961–62 to 1964–65:
- Hills Creek
- Mountain Sheep
- Pleasant Valley
- Mossyrock
- Brownlee
- Oxbow
- Helis Canyon

Added in period 1965–66 to 1974–75:
- Mica Creek
- Arrow Lakes
- Libby
- Glacier View
- Paradise
- Penny Cliffs
- Bruces Eddy
- Priest Rapids
- Wanapum
- John Day
- Grand Coulee (3d powerhouse)
- 4 lower Snake projects
- Wells
- Rocky Reach
- Upper Scriver
- Lower Scriver
- Garden Valley
- Chief Joseph, McNary, and The Dalles (additions).

Senator NEUBERGER. But at the present time, the addition of the Canadian storage would be in your opinion the cheapest power which could be added.

Mr. MCINTYRE. I would not say the cheapest, because I am not prepared to say exactly that, but it would certainly be cheaper than adding any steam or thermal electric generation.

Senator NEUBERGER. It would be cheaper than that. Did you want to add something, Mr. Dubrow?

Mr. DUBROW. I was going to say, Senator, it is quite possible from our point of view that a project such as John Day or any of the run-of-river dams below Coulee on the main stem could be fitted into our system without having a serious impact on the rate.

Senator NEUBERGER. If you could get that material for us it would be beneficial.

Just one other question: Do you know anything that Bonneville is doing, if at all, in connection with the proposals of the Kaiser Co. to build the low dam at Arrow Lakes near Castlegar and of the Puget Sound Utility Council to build Mica Creek and to enter cooperatively into an agreement with the Canadians for its operation and use?

Mr. DUBROW. Yes, Senator Neuberger. We have been diligently working with the other agencies and with our own staff to arrive at the real values involved in the proposal made by the Kaiser Co. in one instance and by the Puget Sound Utilities Council in the other. We are quite aware that the Kaiser people are working against a deadline, which I believe is about May 30. They have a permit which expires then. Bonneville, on the basis of the information that it has assimilated and has worked out with the other agencies, is very shortly to be in a position to make specific recommendations to the Department of the Interior which could form a basis for negotiations with Kaiser or with Puget.

Senator NEUBERGER. Bonneville has not passed on the policy position involved in that, have they?

Mr. DUBROW. No, sir. We are preparing and very shortly now will present to the Department our concrete recommendations as to a basis for negotiations.

Senator NEUBERGER. Do you wish to ask some questions, Mr. Mapes?

Mr. MAPES. I have a few questions for Mr. McIntyre. I realize you have to make a plane this afternoon, Mr. McIntyre, and I don't want to hold you too long. Did you take part in the interagency group study?

Mr. MCINTYRE. Yes; I did take part in that.

Mr. MAPES. Can you tell me, in the study of Mica Creek, was the study made of the year-by-year benefits and costs from that project with the increasing use of steam generation in the system?

Mr. MCINTYRE. No; there were just spot values used for different systems which existed at different times. I think we used the initial base system and phase C level development and then they added steam on top of that.

Mr. MAPES. On what basis should a decision be made on whether or not to build any specific storage project at this time?

Mr. MCINTYRE. I think you have to study it in a lot of different ways: What will it add to the existing system; what will be its usefulness throughout the life of the projects existing and the storage project itself.

Mr. MAPES. If you assume some eventual system and allocate the benefits between the various projects concerned, doesn't that decrease the value of each project?

Mr. MCINTYRE. It would if you did it in that manner.

Mr. MAPES. Perhaps I should ask, is that the way it is done in working out a future system allocation basis?

Mr. MCINTYRE. It is a method which has been proposed. I don't believe it has actually been done up to this time.

Mr. MAPES. Is that not what the interagency group did?

Mr. MCINTYRE. No. The interagency group added these additional projects to the system as a last added project and evaluated them in

that manner, either separately or in combination with other projects. It didn't reevaluate the existing projects.

Mr. MAPES. Did they add them to the present existing system or some future base system?

Mr. MCINTYRE. They did it both ways. They did it to the existing base system in one instance and to a C-level base system in the other instance. Then they added also some steam projects, a certain amount of steam to these systems.

Mr. MAPES. There has been quite a bit of concern expressed about the effect that assuming a future system has on judging the feasibility of these projects. It has been asked by some people if it would not be more proper to take each project and add it to the existing system and at least get on with that project. Can you tell me what basis Bonneville has used in the past?

Mr. MCINTYRE. In the past we have used the incremental system of adding a project.

Mr. MAPES. That is the system I just described, the incremental system, of course.

Mr. MCINTYRE. That is right.

Mr. MAPES. That is the system Bonneville has used in the past?

Mr. MCINTYRE. Yes.

Mr. DUBROW. That is what we use now.

Mr. MAPES. That is what you do use now?

Mr. DUBROW. That is right. For example, Ice Harbor was done that way. Any Federal plant is added that way.

Mr. MAPES. You seem to be using that system and the Army engineers seem to be using a different system.

Mr. DUBROW. No. I don't think so, Mr. Mapes. The difference between what we are actually doing and what was done in the interagency report was to try to give a look into the future over the full pay-out period to get some idea as to the long-range value of Canadian storage projects, for example.

Mr. MAPES. Doesn't taking that long-range viewpoint practically make it infeasible to construct those projects?

Mr. MCINTYRE. I don't think it does.

Mr. MAPES. Do you see any way in which, for instance, the Puget Sound Utilities Council could construct Mica Creek with the interagency study as an engineering basis?

Mr. MCINTYRE. It is pretty difficult for them to come to any decision because of the fact that we have not come to any definite conclusion and there are quite a few engineering studies continuing. I think the Canadians are making studies, and our own Corps of Engineers are making studies. Until those studies are completed, I don't know whether we will get anything different on how you approach this problem or whether it may be done some time before that.

Mr. MAPES. It seems to a good many people that we are hung up in a situation such as you describe right now, and that is the reason I was asking you about it. Assuming the eventual system in which the base is primarily thermal, what would be your concept of the way the hydro system would be used?

Mr. MCINTYRE. That would be probably to maximize energy production rather than prime power as the end product. But there would be a long period when you were changing from prime power to

maximum energy, and storage would be utilized in accordance with the economics during that period.

Mr. MAPES. How much of the energy production might be peaking, for instance?

Mr. MCINTYRE. It depends on load conditions, and also the development of atomic energy may take a different turn. It is in its infancy now and we don't actually know what developments will take place in that field.

Mr. MAPES. When I refer to thermal I am including atomic in my present discussion.

Senator NEUBERGER. If power from atomic energy ever becomes competitive with waterpower, the importance of the Northwest as a potential industrial area will certainly diminish, won't it, because nuclear products are something which can be carried around in a gondola car, presumably, rather than anchored to the particular river system, in which the Northwest does have a great competitive advantage.

Mr. MCINTYRE. Unless the population still continues to move West and it becomes populous, too.

Mr. MAPES. Assuming a thermal-based system, in your opinion would that in any way change the value of upstream storage projects? Would it have much effect of decreasing it?

Mr. MCINTYRE. It would change the value and it probably would be decreasing, but I don't know just how much. I think the result of these studies will tend to firm up that opinion. I think there will always be some value.

Mr. MAPES. Mr. Fernald, of the engineers, said the other day he thought that would help maintain the value of upstream storage because of the need for various kinds of peaking. I can see why that is a point on which engineers can disagree at this point.

Can you give the committee any idea of the effect on present and future developments of the proposed Kootenay-Fraser diversion? How would that affect our Bonneville system?

Mr. MCINTYRE. I have not made any specific studies on that because it actually has been a new development. I think any diversion would affect us, and the effect would be a negative one.

Senator NEUBERGER. Would it lower your present production if they took 15 million acre-feet out of the Columbia?

Mr. MCINTYRE. I think it would tend to do that. I can't say for sure whether it would under the present existing system, but I know it would if the system were larger.

Mr. MAPES. I notice on your chart 1 you used a maximum hydro output apparently between 13 and 14 million kilowatts. Is this intended to show the ultimate development of the system as you foresee it?

Mr. MCINTYRE. That is the way we foresee it at the present time, and assuming these costs for projects we have in there.

Mr. MAPES. Is that the Columbia River system's maximum ultimate potential?

Mr. MCINTYRE. It is the potential prime energy development.

Mr. MAPES. I was thinking in terms of House Document 531, which I believe mentioned the potential of 32 million. Was that merely a theoretical potential?

Mr. McIntyre. I believe that refers more to energy at a certain load factor. I think the Corps of Engineers' testimony last Monday indicated that.

Mr. Mapes. Assuming full development of the system by a single agency, could the ultimate development be higher than shown in your chart 2?

Mr. McIntyre. I think the development is dependent on economics, where you stop, where does the hydroelectric project become more costly than steam?

Mr. Mapes. That is the other subject I wanted to mention: the need for evaluating the Canadian projects with relation to the extent of developments in this country. How would the feasibility of a hydro project be determined as related to the cost of power produced?

Mr. McIntyre. Bonneville does not determine the feasibility, but I believe both the Corps of Engineers and the Bureau of Reclamation use the cost and benefit determination. If the benefits are more than the cost, the project is feasible, and if the reverse is true it is not.

Mr. Mapes. The benefits as compared to a thermal equivalent; is that correct?

Mr. McIntyre. That is right.

Mr. Mapes. So other considerations being equal, hydro projects can be built until the cost of power from them exceeds the cost from equivalent thermal or atomic generation. I believe you stated that on page 3 of your statement.

Mr. McIntyre. Yes.

Mr. Mapes. Would it be fair to say that the cost of money, that is, the necessary return on investment, for these hydro projects has a definite effect on the cost of the power produced?

Mr. McIntyre. I believe it would; yes.

Mr. Mapes. The Federal Power Commission uses various rates of return as being necessary; for instance, from Federal projects and from private projects, and so forth. Can you state what the effect of the rate of return on investment would be on the cost of power from the project?

Mr. McIntyre. The higher the rate, the more costly the power would be in constructing the project.

Mr. Mapes. With higher cost money, the curve of the hydro cost as it rises through the years will necessarily cross the curve of the atomic or thermal cost earlier than it would with lower cost money; would that be correct?

Mr. McIntyre. I am not sure that that would be correct because the cost of money to develop the steam or the nuclear plants would also be in a relative position. The cost of money may cross at an earlier time.

Mr. Mapes. I am sorry. I was comparing the rate of return on hydro investment. With a high rate of return it is going to meet the steam or atomic lines sooner; is it not?

Mr. McIntyre. If the other is constant, that is right.

Mr. Mapes. Actually there would be less development of hydro sites feasible with the higher cost of money.

Mr. McIntyre. I think that would be correct.

Mr. Mapes. That is all I have, Mr. Chairman.

Senator Neuberger. Thank you very much, gentlemen, for coming here today. We are going to run until 4 o'clock today. We have some

more witnesses. Fortunately they are all from Washington, D. C., I understand, so if we cannot complete them today we will go over until some time after the recess. I want to thank both Mr. McIntyre and Mr. Dubrow for coming here and giving us this useful information. You are more than cooperative, and we are very pleased to have had you.

Mr. DUBROW. We are glad to have had the opportunity to testify.

Senator NEUBERGER. Do we have some representatives from the Bureau of Reclamation? They gave us some alternative names, so I don't know who is on hand.

STATEMENT OF DANIEL V. McCARTHY, CHIEF, BRANCH OF PROGRAM COORDINATION, PROJECT DEVELOPMENT DIVISION, BUREAU OF RECLAMATION

Mr. MCCARTHY. I am Daniel V. McCarthy, Chief of the Branch of Program Coordination, Project Development Division, Bureau of Reclamation. I am pleased to be here today.

Senator NEUBERGER. We are happy to have you, Mr. McCarthy.

Mr. MCCARTHY. Senator Murray asked the Bureau of Reclamation to present information on the possible effects of diversion of the Columbia River flows in Canada on the future development of irrigation in the United States. I have a very brief statement here which covers the information desired as well as we can. I would like to present it.

The various diversion plans discussed or under study including diversion of Kootenay River into the Columbia at Canal Flats and diversion of the Columbia into the Fraser River could possibly affect future irrigation development in the United States in two ways: (1) Through reduction of water supply needs for irrigation and (2) through reduction of low-cost power needed for irrigation pumping and of power revenues which are a potential source of financial assistance to irrigation development.

In respect to water supply there is no basis for concern that any possible diversion of flows in Canada could restrict or delay future irrigation development in the United States. Studies indicate that potential irrigation development diverting water from the Columbia River below the Canadian border might be as much as 1,675,000 acres involving a diversion of 7,655,500 acre-feet annually and a consumtive use of 4,406,000 acre-feet. Compared to the present average annual flow of the Columbia River at Grand Coulee Dam of 78 mililon acre-feet, these requirements represent but a small percent of available flows. Even if all of the available flows of the Columbia River at Mica Creek were diverted to the Fraser River during the critical months of May through September, there would remain ample water to take care of all potential irrigation developments in the United States.

Any diversion of Columbia River flows would, however, reduce power generation at Columbia River hydroelectric plants in the United States, and this could have an appreciable adverse effect on future irrigation development.

Studies indicate an irrigation development potential in the Columbia River Basin of some 4 million acres of land within the next 50

years not including the Columbia Basin project. Development of practically all of these lands will depend upon some form of financial assistance (most likely from power revenues), a source of power for pumping at low cost, or both.

The Columbia River powerplants are the most important source of these aids to irrigation and any reduction in their output might well be reflected in a slower rate of irrigation growth in the Columbia Basin and in the elimination of some lands which otherwise might be feasible. Just how extensive the adverse effects might be would depend upon many factors including the magnitude of reduction of power output, the effect on rates for pumping power, future policy in respect to use of surplus power revenues in aid of irrigation and the effect of reduced generation upon surplus power revenues available for assistance to irrigation.

Until various specific diversion schemes are analyzed as to the magnitude and timing of their effects on power generation at Columbia River plants in the United States, only the generality can be made that the greater the diversion, the greater is the likely effect on irrigation development.

Senator NEUBERGER. In other words, Mr. McCarthy, you have confined your comments mainly to the impact of diversion on irrigation.

Mr. MCCARTHY. That is correct. That was our understanding of Senator Murray's request.

Senator NEUBERGER. You are correct in that. Of course as you point out, irrigation is dependent upon power subsidy or benefits, whatever you want to call it. So anything which would diminish power production potential could have an adverse effect on irrigation.

Mr. MCCARTHY. That is correct.

Senator NEUBERGER. Has the Bureau of Reclamation made any study of the added power production at such places as Grand Coulee due to Canadian storage and what the costs of that production would be?

Mr. MCCARTHY. No studies other than those we have participated in with the interagency group. That is the extent of our specific studies, Senator.

Senator NEUBERGER. You have not come up with any conclusion as to what sequence you think the projects should be constructed insofar as the Columbia Basin is concerned?

Mr. MCCARTHY. That is correct; we have no specific responsibility in that respect.

Senator NEUBERGER. Mr. Mapes, do you have any questions you want to ask Mr. McCarthy?

Mr. MAPES. I just wanted to ask if you are familiar at all with the third powerhouse study at Grand Coulee which I believe the Bureau made.

Mr. MCCARTHY. Yes; we have studies underway on that.

Mr. MAPES. Are you familiar with those studies?

Mr. MCCARTHY. Not familiar enough to testify with any accuracy.

Mr. MAPES. As to the effect upstream diversion would have on the possibility of such a third powerhouse at Grand Coulee?

Mr. MCCARTHY. That is correct, just the general conclusion, which is evident, that any diversion would adversely affect the addition of any power to the system.

Senator NEUBERGER. Thank you very much, Mr. McCarthy.

Is there somebody here from the United States Geological Survey?

STATEMENT OF CHARLES C. McDONALD, HYDRAULIC ENGINEER, GEOLOGICAL SURVEY

Mr. McDONALD. Mr. Chairman, I am Charles McDonald, hydraulic engineer of the Geological Survey. We have a prepared statement providing the information requested in the chairman's letter to the Secretary of the Interior. With your permission, due to the lateness of the hour and the fact that some of the information here is subsidiary to the specific questions which were asked, I would like to submit it for the record and not read it.

(Mr. McDonald's prepared statement follows:)

ESTIMATES OF POTENTIAL WATERPOWER IN THE COLUMBIA RIVER BASIN BY THE UNITED STATES GEOLOGICAL SURVEY[1]

The potential waterpower resources of the Columbia River Basin within the United States were first estimated by the Geological Survey in 1908. At that time the minimum potential power, essentially that available without storage 90 percent of the time, was estimated to be 10,461,000 horsepower; and the assumed maximum potential power, that available 50 percent of the time, was estimated to be 19,741,000 horsepower. With more adequate knowledge of streamflows and better maps, revisions were made in 1924 which indicated a minimum of 9,840,000 horsepower and a maximum of 16,942,000. In 1936, the latest year for which the Survey has made estimates of potential waterpower by river basins, the minimum potential for the Columbia River Basin was estimated to be 15,108,000 horsepower and the maximum 19,071,000 horsepower. Since 1936 estimates by the Geological Survey have been made by States as a part of the appraisal of the world power resources.

The first estimates by the Geological Survey of the potential waterpower of the United States were prepared in 1908 for the National Conservation Commission, and were published in Geological Survey Water Supply Paper No. 234 and also in a report by the National Conservation Commission. These estimates were revised by the Commissioner of Corporations for his Report on Waterpower Developed in the United States, 1912, and by the Forest Service in 1916. These revised estimates were incorporated into the estimates of developed and potential waterpower of the world prepared by the Geological Survey for use at the Versailles Peace Conference and were published in the World Atlas of Commercial Geology, Part II, Waterpower of the World, in 1921.

Several reports have been made since 1921 incorporating revisions to previous estimates. These have been released in mimeographed form. The 1952 and 1954 estimates were published as Geological Survey Circulars 329 and 367, respectively, Developed and Potential Waterpower of the United States and Other Countries of the World. The 1908 estimates were based on the information available regarding the primary factors of fall, discharge, and the effects of storage. Accurate information on these basic factors was inadequate for many of the streams at that time. With the progress of topographic mapping and stream gaging, more reliable information on the basic factors has become available and subsequent estimates adjusted accordingly. The general increase in the estimated values of potential power has resulted primarily from more adequate data becoming available from year to year along with a pronounced change in concepts relating to feasibility of development during the past 30 years and higher assumed efficiency. The consideration of larger storage developments resulting in a more favorable distribution of streamflow for power development also has been a major contributing factor in increasing the estimated values. The present estimates are believed to be reasonably accurate and any changes in subsequent years are not expected to have any material effect on the overall totals.

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[1] Prepared statement of Charles C. McDonald, hydraulic engineer, U. S. Geological Survey, for Senate Interior and Insular Affairs Committee, March 26, 1956.

Estimates of potential waterpower have been made for two conditions: (1) power available 90 percent of the time, representing the amount of power that would be available at times of minimum flow and without storage; and (2) power available 50 percent of the time, representing what was at the time considered to be the maximum economical development. Estimates for the four States of Washington, Oregon, Idaho, and Montana, encompassing essentially all of the Columbia River Basin within the United States is shown in the following table for various years. The values for the United States are also included as a matter of information. The estimates through 1949 are based on gross head and 70 percent efficiency. Since them, in order to conform with international standards established by the World Power Conference, the estimates have been based on gross head and 100 percent efficiency. Hence, potential estimates may be in excess of practical development.

Estimates of potential waterpower

[Thousands of horsepower]

Year	United States		Washington		Oregon		Idaho		Montana	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
1921 [1]	27,943	53,905	4,932	8,647	3,148	6,613	2,362	5,067	2,749	4,331
1924 [2]	34,818	55,030	4,970	7,871	3,665	6,715	2,122	4,032	2,550	3,700
1934 [2]	41,701	60,276	8,800	12,000	4,400	6,300	2,550	3,550	2,410	3,300
1936 [2]	42,735	57,184	8,768	12,021	4,361	5,956	2,706	3,688	1,306	1,853
1939 [2]	42,901	57,412	8,768	12,021	4,502	6,104	2,706	3,688	1,306	1,853
1946 [2]	43,841	58,375	8,855	12,146	4,652	6,312	2,706	3,688	1,306	1,853
1949 [2]	44,512	58,848	8,855	12,146	4,652	6,312	3,171	4,109	1,834	2,249
1954 [3]	65,374	85,655	12,711	17,414	6,753	8,999	4,530	5,870	2,770	3,359

[1] Original estimates made in 1908 published in 1921 with some revisions.
[2] Minimum is waterpower available 90 percent of time; maximum is waterpower available 50 percent of time with present and future storage, 70 percent efficiency, and gross head at known power sites.
[3] Same as footnote 2 but computed at 100 percent efficiency to conform to international standards for estimating potential waterpower.

A rough measure of the extent to which the potential waterpower of the Columbia River Basin within the United States has been developed is indicated in the table below which gives the installed capacity at the developed sites in the four Pacific Northwest States as well as for the United States. In considering the values in this table it must be remembered that installed capacity at any power development invariably exceeds the potential prime power available at that site. The excess amount varies with conditions but an installed capacity considerably in excess of the potential power available 50 percent of the time is not uncommon.

Installed capacity at developed waterpower sites in the United States and in the Pacific Northwest States [1]

[In horsepower]

Year	United States	Washington	Oregon	Idaho	Montana
1908	5,356,680	147,041	231,379	78,743	148,052
1924	9,086,958	480,356	206,865	270,918	345,040
1930	13,807,778	765,757	298,927	358,002	419,110
1934	15,913,451	1,037,127	364,052	347,822	427,884
1936	16,079,407	1,244,672	361,106	356,947	428,884
1937	17,119,610	1,227,359	361,106	356,947	428,884
1953	28,760,000	4,290,000	1,098,000	853,000	810,000

[1] Data through 1937 by Geological Survey. Data for 1953 by the Federal Power Commission.

Senator NEUBERGER. Please go ahead, Mr. McDonald.

Mr. MCDONALD. I would like to call to your attention a few of the estimates of potential power on the Columbia River and its tributaries in the United States. I may explain that we have considered only the United States portion of the basin and not the Canadian portion.

We have historically three estimates for the Columbia Basin: 1908, 1924, and 1936. Since 1936 we have not made a specific estimate for river basins in the United States. In the Columbia Basin, because of the activities of the Federal Power Commission, they have pretty much taken that activity over.

Estimates that we have made, however, were made under two conditions: A minimum and a maximum, the minimum representing the power available from streamflow which is there 90 percent of the time and the maximum, what we would call the maximum, representing power available from streamflow which is available 50 percent of the time.

I might review the changes which have occurred. In 1908 our minimum was estimated to be 10,461,000 horsepower. In 1924, that minimum had dropped to 9,840,000 horsepower. In 1936 it had come up considerably to 15,108,000 horsepower.

That change between 1908 and 1924 was probably due to improved estimates of streamflow, improved streamflow records and improved topographic maps.

Subsequent to 1924, however, additional storage was developed on the river which does affect the minimum. It does not affect the maximum to any degree. That estimate of maximum from 1908 to 1936 remains essentially constant and we would consider that that is effective as of now.

We have confined it to horsepower, although the conversion is a linear relationship and by applying a factor of approximately three-fourths, the horsepower figures were converted to kilowatts.

The statement provides some additional tabulation by States and for the United States merely for the information of the committee in case they are interested.

That concludes my statement, unless you have some questions.

Senator NEUBERGER. Mr. Mapes, do you have any questions of this witness?

Mr. MAPES. I have several questions here, Mr. Chairman.

I note that in your statement you mention storage reservoirs as a "major contributing factor" for the increase in power potential estimated for the Columbia Basin. In the light of a reduction of storage projects currently contemplated in the basin, do you anticipate any need for downward revision in your figures?

Mr. MCDONALD. The figures which we have given are based only on storage existing at the time. In fact, they reflect only indirectly the effect of storage. The regulation created by Grand Coulee, for instance, would affect the streamflow which is available 90 percent of the time and, as a result, would affect indirectly our estimates of the power available 90 percent of the time.

But the question of storage does not come in directly in our estimates.

Mr. MAPES. One other term you used there. You spoke of a pronounced change in your concept of feasibility as a factor in determining the power potential. Could you give us an explanation of what the change was there?

Mr. MCDONALD. That results from a consideration of some of the reaches of river which at one time would not have been considered available for power development, but with the development of high

dam and large projects, the fall in those reaches of river have become a factor in the potential power.

Mr. MAPES. Do you have here the figures for the total development potential in the Northwest? You have the United States total.

Mr. MCDONALD. We have the four States. I have added up Washington, Oregon, and Idaho.

Senator NEUBERGER. I think it adds up to about 35 million horsepower.

Mr. MAPES. I used the 1949 figures and I got 24.8 million horsepower, which would be about 18.6 million kilowatts. I am a little bit confused by that figure because, taking an excerpt from the 34th Annual Report of the Federal Power Commission, which was in 1954, on page 80 the report states:

> The North Pacific drainage, which includes the Columbia River Basin, has the largest amount of undeveloped power of all the major drainages, totaling 33,995,000 kilowatts. Leading the country, the Columbia Basin alone has approximately 30,220,000 kilowatts.

Can you make those figures come closer together for the committee?

Mr. MCDONALD. I believe the Federal Power Commission considers as potential power the potential installed capacity of plants in the system which, as the Bonneville people testified, would perhaps have a very low load factor. Our assumption is based upon flows available 50 percent of the time. So the two figures would not necessarily be comparable. The installed capacity might considerably exceed the power available 50 percent of the time, which is essentially a 50 percent load factor.

Mr. MAPES. I notice that General Itschner in his statement the other day gave an average maximum potential of 19 million kilowatts, with a practical limit of 12.5 million kilowatts. He similarly gave a peaking maximum potential of 45 million and a practical limit of 28 million.

Would that 19 million average maximum potential be about the same thing you mean?

Mr. MCDONALD. Yes. The assumptions are quite close in there. The two figures should be comparable.

Senator NEUBERGER. The Northwest has about a third of the potential hydroelectric power in the United States; is that correct?

Mr. MCDONALD. That is correct, sir. In 1936 our estimates for the Columbia Basin and comparable estimates for the entire United States give 33 percent, which confirms your one-third.

Senator NEUBERGER. I think that is important because there has been some criticism of the fact that such a substantial proportion of Federal appropriations for river development are spent in the Northwest. I think it is important to bring out that this is the logical place just as the seacoast is the logical place to spend money for jetties, lighthouses, Coast Guard stations, and so on.

Unless Mr. Mapes has some more questions of Mr. McDonald, we certainly appreciate the information and tables you brought us.

Mr. MAPES. May I ask one question more on the snow pack figures?

Senator NEUBERGER. Certainly.

Mr. MAPES. I recently put together a set of figures for the Columbia Basin for the various courses and they indicated a substantial increase at the present time over similar figures for 1948. Can you

tell us approximately which are the major contributors to the Columbia River of the courses listed in the left-hand column there?

Mr. McDONALD. I can give you some approximate figures for annual runoff which would be very close to the runoff during the flood season.

Mr. MAPES. The ratio would be quite similar?

Mr. McDONALD. The ratio should be quite similar. The upper Columbia above Kootenay produces about 33 million acre-feet on the average, or about 18 percent of the total of the Columbia Basin as a whole. The Columbia River above the Snake produces about 92 million acre-feet per year out of 174.

Mr. MAPES. That includes the 33 million?

Mr. McDONALD. That includes the 33 million. So everything down to the mouth of the Snake would produce 92 million out of 174 million on the average.

Then the Snake River Basin, which you have listed separately here, produces about 37 million.

Mr. MAPES. Can you divide the Snake into the Salmon and the Clearwater and the Snake above the Salmon?

Mr. McDONALD. Yes. The Snake River itself, without the Salmon and Clearwater, is about 12.8 million acre-feet per year. The Salmon River produces about 7.5 million acre-feet per year. The Clearwater River produces about 10 million acre-feet per year. That makes up the contribution of the Snake, which all together is about 20 percent of the lower Columbia.

The rest of the Columbia, then, below the Snake River produces about 51 million acre-feet per year, or about 28 percent of the total.

Mr. MAPES. Would it be correct to say that the Deschutes, John Day, and Willamette are the three largest of those lower river tributaries?

Mr. McDONALD. Yes. There are some smaller tributaries which produce substantial but not major amounts.

Mr. MAPES. Has your agency made any estimate of the potential flood runoff, peak runoff this year?

Mr. McDONALD. Sir, we would not make estimates of that runoff.

Mr. MAPES. The Army engineers do that?

Mr. McDONALD. That is right. We participate by providing current information on the flows and other matters within our field.

Senator NEUBERGER. Thank you very much, Mr. McDonald. I want to say before we recess these hearings, to be reconvened following the Easter interval of Congress, it seems to me the significant thing which has been brought out by questioning people with technical information about the watershed of the Columbia River is the fact that the bulk of those who would voice an opinion felt, if there were no international line and thus no international involvement, the two projects which should be built next in order for maximum efficiency and benefit would be Libby Dam and Mica Creek Dam. It is my hope that the committee will have a further opportunity to question ex-Governor Jordan, the Chairman of the International Joint Commission, about his statement to the committee last week and also about his statements as Chairman of the International Joint Commission concerning the mutual use with Canada of the upper Columbia River.

Just speaking for myself alone, as just one member of the committee, I hope particularly to ask Mr. Jordan about his comments in Canada on several occasions when it seemed to me that he minimized the value to the United States and the advantage to the United States of storage projects in Canada.

Also it seems to me that he has more or less deliberately chosen a sequence of development which would tend to minimize the advantage of Canadian projects and on one occasion even set down a sequence which led him to point out that "storage projects in Canada will no longer afford a large advantage to the United States."

In my opinion, while this may not be completely in conflict with some of the statements the committee has taken, I would say that it was at least in contrast with statements that if there were no international line, the projects that next should be built would be Libby and Mica Creek.

It is my opinion that Libby and Mica Creek would be of great advantage to our two countries, that they would not involve great damage to fisheries and that somehow we have to work out a system of downstream benefits which will make it feasible for the Canadians to enter into an agreement with us for the building of Libby and Mica Creek and thus to avoid the proposed diversion to the Fraser River which would be so disastrous to the United States.

We stand in recess.

(Whereupon, at 4 p. m., the committee was recessed subject to call.)

UPPER COLUMBIA RIVER DEVELOPMENT

WEDNESDAY, MAY 23, 1956

UNITED STATES SENATE,
COMMITTEE ON INTERIOR AND INSULAR AFFAIRS,
Washington, D. C.

The committee met, pursuant to call, at 10 a. m., in room 224, Senate Office Building, Senator Richard L. Neuberger, of Oregon, presiding.

Present: Senators Richard L. Neuberger, of Oregon; William R. Laird III, of West Virginia; and Henry Dworshak, of Idaho.

Senator NEUBERGER. The committee will come to order, please.

I understand that Senator Murray, who has another committee meeting, will be late in coming, so we will start in his absence.

Before we commence our hearing, I would like to place certain material into the record. I will just enumerate what the material is.

First is a letter from Senator Morse, the senior Senator from Oregon, to the chairman of the committee, to be inserted at page 93 of the transcript.

Second is a letter with a statement from the Kaiser Aluminum & Chemical Corp., which will follow my brief opening statement now.

Third is a statement by the Puget Sound Utilities Council of the State of Washington, to follow the Kaiser Aluminum statement.

Fourth is a chronology of Libby Dam and the proposed Fraser River development prepared by the staff of the committee.

Fifth is a letter of the Pacific Northwest Public Power Association, with exhibits. In order to keep the exhibits with the statement I am suggesting that this letter and exhibits be placed in the record at the end of today's testimony but as part of that testimony, according to the request of that group.

(The material referred to follows:)

KAISER ALUMINUM & CHEMICAL CORP.,
Washington, D. C., April 16, 1956.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

DEAR SENATOR MURRAY: In accordance with your request of March 21, 1956, we wish to submit the following statement in connection with our interest in adequate water storage and additional electric power generation in the upper Columbia River Basin.

Kaiser Aluminum & Chemical Corp. in 1954 proposed that it privately finance and construct the $30 million Arrow Lakes storage dam on the Columbia River in British Columbia.

The excess water to be stored at Arrow Lakes would be released under an arrangement with the Bonneville Power Administration for the generation of additional electric power in the United States downstream powerplants that would not otherwise be generated.

In furtherance of this cooperation of private enterprise with the Federal Government, Kaiser Aluminum initiated discussions in 1954 with officials of British Columbia and the Bonneville Power Administration and the Department of the Interior as further explained below.

Kaiser Aluminum owns and operates extensive aluminum reduction and fabricating facilities in the Pacific Northwest. In connection with these operations the company needs and presently purchases from Bonneville Power Administration some 4,200 million kilowatt-hours of electrical energy annually. Efficient operation of an aluminum reduction plant requires a continuous or 100-percent load factor electrical supply. Approximately 43 percent of our Pacific Northwest energy requirements is provided by what is known as interruptible or dump power. Obviously, dependency of our Northwest production on such a large proportion of "interruptible power" does not assure continuity of aluminum production, or continuity of employment to our 6,400 full-time employees and their families.

Kaiser Aluminum has long sought to secure a firm power supply for its Northwest operations and, in that connection, has investigated all possible sources from which it might protect itself. The Arrow Lakes project is definitely feasible and offers opportunities to increase the supply of electric power in the Northwest by our company, working cooperatively with the Federal Government. Construction of the Arrow Lakes storage facilities can provide upstream storage usable for downstream hydroelectric projects, including those owned by and located in the United States, operated by the United States, and merchandised by Bonneville Power Administration. This added Arrow Lakes storage will provide some 330,000 additional kilowatts of firm power downstream, predicated on presently installed capacity, plus that now under construction.

On September 17, 1954, Kaiser Aluminum signed a contract with the Province of British Columbia setting forth the basis upon which the company would be permitted to construct its proposed dam at the foot of Arrow Lakes on the Columbia River. Subsequently, the Canadian Federal Government at Ottawa enacted bill No. 3 which requires a Canadian Federal license on any project which alters the flow of water across the border.

Kaiser Aluminum has, from the inception of its interest in the project, kept the United States Government advised of developments through the Bonneville Power Administration. On September 24, 1954, a meeting was held at the offices of the Bonneville Power Administration with the Administrator and members of his staff, and representatives of the Corps of Engineers and the Bureau of Reclamation. The latter two agencies constructed and operate some of the dams at which water stored in Arrow Lakes would be utilized for the generation of power. At this meeting formal negotiations for an agreement with the United States Government were initiated. The matter was turned over for study to a committee of Federal agencies who issued a report in January 1955. This report was apparently the subject of further discussion among the Federal agencies, and we received a copy on July 20, 1955. Since that time negotiations with Bonneville and the Department of the Interior, including also some technical discussions with the Corps of Engineers and the Federal Power Commission, have been pursued.

Our original contract with British Columbia provided that the company would, on or before March 1, 1955, organize a Canadian company and cause that company to apply for a conditional license. The company obviously would not be able to apply for such a license until agreement had been reached with the United States Government as to the division of power which would be produced by storage at the project. Since agreement had not been reached by March 1, 1956, the company applied for and received from the Province of British Columbia two extensions, the second of which is now running and expires on May 30, 1956.

After having reached agreement with the Province on September 17, 1954, the company proceeded promptly to perform the drilling and other fieldwork required by the agreement and determined upon a favorable site at which 3 million acre-feet or more of water could be stored. The cost of such a dam as mentioned previously would be approximately $30 million. There is adequate water in every year to more than refill such storage even if every drop of water were stored at the Mica site above Arrow Lakes during the refill period, April through August. The inflow below Mica is approximately double the amount required even in the lowest year of record. For this reason the construction of a dam at Arrow Lakes is also quite independent of the diversion of floodwaters of the upper Columbia, and possibly also of the upper Kootenay, now being studied by the Canadian Government.

Hon. Len Jordan, Chairman of the American Section of the International Joint Commission has advised us officially that the International Joint Commission has no jurisdiction over the proposed storage in Arrow Lakes, although they wish to be kept advised of developments because of the so-called Columbia River reference made to the International Joint Commission by the Governments of the United States and Canada in 1944.

The power situation in the Northwest is currently tight because in a critical year there would be no interruptible electric power at all, and very substantial amounts of high-cost steam electric power would have to be generated to serve even Bonneville's customers who have contracts for firm power. This situation generally will continue until about 1959 or 1960. After that, unless some large projects developing electric power get underway very promptly, the situation will rapidly become critical so that actual curtailment of firm power loads will take place in case of low water conditions. The Arrow Lakes project, which can be built in a period of 2 to 3 years, is ideally suited to provide additional power to the area by 1959. The Federal agencies have agreed that Arrow Lakes Dam as proposed would add 331,000 kilowatts of prime power to the Federal dams now existing and under construction. Of this amount, under our proposal, one-half, or approximately 165,000 kilowatts, would be available to Bonneville Power Administration as an addition to its general power supply in the Pacific Northwest. The other half would be used by Kaiser Aluminum, partly for compensation to the Province of British Columbia and partly to firm up a portion of Kaiser Aluminum's present interruptible power. Kaiser Aluminum's interest in financing the project is to obtain this portion of the additional power to assure continuity of its Northwest operations.

While there has been disagreement between the Province of British Columbia and the Canadian Federal Government as to Arrow Lakes, we are confident that if a satisfactory arrangement can be promptly arrived at with the United States Government, the Canadian problems will be solved so that the dam can go ahead. This view is supported by recent newspaper items indicating that Premier Bennett of British Columbia and Mr. Lesage, Minister of Northern Affairs and Natural Resources, have resumed discussions on a cooperative basis.

The nature of the Arrow Lakes project as proposed by Kaiser Aluminum and the company's contract with British Columbia and the participation of Bonneville Power Administration, we feel, precludes any international question with respect to the effect of possible diversion of the Columbia River at or above Mica Creek, diversion of the upper Kootenay, or with respect to flooding of land at Libby or elsewhere on either side of the international boundary.

In the light of the facts outlined above, we hope that our private development of the Arrow Lakes project can proceed without delay so that additional electric power can be supplied to the Pacific Northwest through the productive use of existing power generating facilities and those under construction and planned, that would not otherwise be used.

Sincerely yours,

CHAD F. CALHOUN,
Vice President.

STATEMENT BY THE PUGET SOUND UTILITIES COUNCIL TO THE CHAIRMAN OF THE SENATE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS ON POWER DEVELOPMENT OF THE COLUMBIA RIVER BASIN, CANADA AND THE UNITED STATES

The hydroelectric power potential in the Pacific Northwest is extremely great, but various conflicts of interest are having the effect of eliminating otherwise economically feasible projects from the field of possible development. This is particularly true with regard to storage developments. In many cases, property improvements and populations have expanded in storage areas to the point where the people and their interests would be seriously affected by reservoir encroachment. A list of major reservoirs presently beset with conflicts would include Libby, Glacier View, high Hells Canyon, Nez Perce, Bruces Eddy, and Penny Cliffs. There are very few power projects, either storage or run of river, that are free from opposition of some kind.

Limited opportunities for power developments make it necessary for Northwest power distributors to look to other sources for new long-range power supplies. The Puget Sound Utilities Council, in addition to proposing the development of a considerable number of plants in the Pacific Northwest, has been working toward the possibility of developing a large amount of storage at the Mica

Creek site on the Columbia River in British Columbia. This project would develop about 10.5 million acre-feet of storage for use through downstream Columbia River plants. Benefiting plants now constructed, or actually under construction, are Grand Coulee, Chief Joseph, Rock Island, McNary, The Dalles, and Bonneville. Mica Creek storage would increase prime power production of the Federal system, plus the non-Federal Rock Island plant, by 1,161,000 kilowatts.

Columbia River plants proposed for early construction include Priest Rapids, Wanapum, Rocky Reach, and John Day. Mica Creek storage would increase the prime power production at these by an additional 648,000 kilowatts. When all of these plants are developed, the total benefit in prime power due to Mica Creek storage will amount to 1,809,000 kilowatts. This is more than the prime power now produced at Grand Coulee.

The Puget Sound Utilities Council has offered to construct the Mica Creek Dam at an approximate cost of $250 million. Under the proposal made to officials of British Columbia and the Dominion, the council would construct the dam at its own expense, and transfer ownership to the Province, with the understanding that stored water would be released in such manner as to be usable for maximum prime power production at downstream Columbia River plants. The Province could install generators at Mica Creek and obtain very low-cost energy since the major cost of the project would be in the dam which would be paid for by the council. The proposed storage operation would be compatible with power operations of British Columbia utilities since load shapes and streamflow patterns are substantially the same in both areas.

Since most of the benefiting plants are owned by the United States Federal Government, some arrangement must be made for the use of Federal facilities. The Bonneville Power Administration is working out a use-of-facilities formula which will compensate the Government for the use of its generating and transmission facilities to convert Canadian storage to power, and deliver the power to load centers.

During the past year, the Dominion inaugurated investigations for the diversion of water from the Kootenay River to the Columbia River at Canal Flats, and for the diversion of water from the Columbia to the Fraser River. The Kootenay diversion would destroy the economic feasibility of the Libby project in Montana, and the Columbia diversion would adversely affect downstream Columbia River plants in the United States.

Storage development opportunities are greater in British Columbia at this time because that country has not developed as rapidly as United States portions of the Pacific Northwest. Consequently, property improvements have not occurred in storage areas, and conflicts of interest are not as serious as in the United States. Everything should be done to encourage a working arrangement between the United States and Canada for a comprehensive development of related national and international hydroelectric power resources. The Pacific Northwest is growing very rapidly and power needs are exceeding all previous estimates. New power supplies are, therefore, urgent. The Puget Sound Utilities Council wishes to cooperate with the Canadians in the development of power resources for mutual benefit.

For your general information, the Puget Sound Utilities Council consists of Seattle City Light, Tacoma City Light, Puget Sound Power & Light Co., Snohomish County Public Utility District No. 1, and Chelan County Public Utility District No. 1. These utilities own and operate 24 hydroelectric and steam-electric plants, with associated transmission and distribution facilities. The maximum capability of the combined systems is about 1.6 million kilowatts. In addition, each utility has a long-term contract for the purchase of firm power from the Federal Government. The council utilities serve a population of over 1,500,000 people, represented by 540,000 customers. The service area extends 150 miles north from Olympia, Wash., to the Canadian border, and about the same distance east from the Puget Sound to Wenatchee, Wash. Gross annual income of the 5 utilities is over $75 million, and total combined assets are about $575 million.

The council utilities are moving forward on a large-scale power-development program and now have applications before the Federal Power Commission for the construction of projects which will have an ultimate total installed capacity of over 1 million kilowatts. Industries in the Puget Sound-Cascade region are being encouraged to expand, and new industries are being invited to settle here. New and larger industries will mean continued regional prosperity, larger payrolls, and job opportunities for the rapidly increasing population.

LIBBY DAM (KOOTENAI RIVER DIVERSION) CHRONOLOGY

May 17, 1950: Libby Dam authorized by Flood Control Act of 1950.

January 12, 1951: State Department filed application with International Joint Commission for approval of Libby Dam.

March 12–16, 1951: International Joint Commission held public hearings on Libby application in British Columbia and Montana. Objections to project filed.

April 8, 1953: United States withdrew Libby application upon request of Secretary of the Army to Secretary of State.

January 27, 1954: Chairman of Canadian Section of International Joint Commission announced study of feasibility of Kootenai diversion at Canal Flats.

May 22, 1954: State Department filed new application with International Joint Commission for Libby.

July 7, 1954: Canadian Secretary of State for External Affairs informed International Joint Commission that Canada was not prepared to consent to the United States application or to oppose it; he also indicated that in such consent were to be given, Canada would want compensation for additional head of water used and downstream benefits resulting therefrom.

September 28, 1954: The United States Department of State informed the International Joint Commission that the United States was "prepared to consider equitable recompense to Canada through the sale of power, or otherwise, for the value which the Canadian natural resources would have for the production of power, taking into account the extent to which the project will result in compensatory benefits in Canada."

March 9, 1955: Chairman McNaughton, of the Canadian Section of the International Joint Commission told Committee on External Affairs: "We have now the new application from the United States Secretary of State, Mr. Dulles. This does not seem to represent any more favorable approach to the problem of an equitable division of benefits. The reply made by the Government of Canada indicates we will not be prepared to go on with the discussion until we know the possibilities of the Kootenay diversion, among other matters."

April 5, 1955: Chairman of Canadian Section of International Joint Commission announced plans for study of diversion of from 5,000 to 8,000 cubic feet per second from Kootenay to Columbia at Canal Flats, average flow of Kootenay into the United States is only 9,500). Expected diversion studies would require 12 to 15 months.

FRASER RIVER DIVERSION CHRONOLOGY

December 20, 1954: Canadian Minister of Northern Affairs and National Resources (Lesage) announced feasibility study of diversion from upper Columbia to Fraser River system.

March 9, 1955: Chairman of Canadian Section of International Joint Commission informed House of Commons Committee on External Affairs that 3½ years would be required to complete the full study of the Canadian portion of the Columbia Basin.

April 5, 1955: Chairman of Canadian Section of International Joint Commission announced a study of a plan to divert some 15 million acre-feet per year from Columbia to Fraser above Revelstoke, about 67.7 percent of the long-time average flow of the Columbia at Revelstoke. Also said diversion studies would require 12 to 15 months to complete.

May 13, 1955: Canadian Parliament authorized special appropriation of $250,000 for engineering studies of Columbia-Fraser diversion in following year.

Senator NEUBERGER. I also am including a few items for the appendix of the hearing record. The first is a group of newspaper articles from the Vancouver, British Columbia, Province concerning the recent proposal of Prime Minister St. Laurent to Dwight D. Eisenhower, concerning top-level negotiations on the problems of upper Columbia River development, along with such other articles and editorials on this general subject as may be submitted for the record before it is closed.

Second, a resolution adopted by the Northwest Public Power Association at its annual meeting in Spokane April 12, 1956.

Third, a document prepared by Ebasco Services, Inc., entitled "Preliminary Report, Effect of Mica Creek and Arrow Lakes Storage on Columbia River Power Supply in United States of America."

Fourth, a letter from the chairman, Senator Murray, to Mr. Jack Stevens, consulting engineer of the Puget Sound Utilities Council, concerning the Ebasco Services Report and the special interagency study, together with Mr. Stevens' reply, when it is received.

Fifth, reprint of an article in the Winnipeg, Manitoba, Free Press by Grant Dexter entitled "Attack on Canadian Power," provided to Dr. Paul Raver, superintendent, Seattle City Light, by Mr. C. Norman Senior, consul general in Seattle.

Sixth, address of Monday, May 9, 1955, by Hon. Jean Lesage, Minister of Northern Affairs and National Resources of Canada, before the Pacific Northwest Trade Association at Vancouver, British Columbia.

(The documents referred to appear at the end of today's record.)

Senator NEUBERGER. Our first witness this morning will be Mr. Stewart Brandborg, representing the National Wildlife Federation. Mr. Brandborg.

STATEMENT OF STEWART M. BRANDBORG, ASSISTANT CONSERVATION DIRECTOR, NATIONAL WILDLIFE FEDERATION

Mr. BRANDBORG. Mr. Chairman, I am Stewart Brandborg, assistant conservation director of the National Wildlife Federation.

The National Wildlife Federation is composed of organizations of sportsmen and lay conservationists in the States, the District of Columbia, and Alaska. It serves as a clearinghouse for information on conservation and as a medium through which lay conservationists at the local, State, and regional levels can work together to bring about the wise use of our national resources.

I have come here today to urge the development of comprehensive plans for making the wisest use of the water and other resources of the Columbia River Basin, particularly in those cases where impoundment projects would have a devastating effect on wildlife and recreation values.

The National Wildlife Federation has recently had occasion to appear before Public Works Subcommittees of the Senate and House Appropriations Committees to offer opposition to the current proposals for Bruces Eddy and Penny Cliffs Dams on the Clearwater River in Idaho. We are supported in this position by our State affiliate in Idaho, the Idaho Wildlife Federation, and the tristate organizations representing the three National Wildlife Federation affiliates of the middle Snake River drainage, the Idaho-Oregon-Washington Wildlife Federation. I would like at this time to request permission to have the resolutions of these organizations, which more clearly define their positions, included in the record of this hearing.

Senator NEUBERGER. Without objection it is so ordered.

(The resolutions referred to follow:)

RESOLUTION PASSED BY IDAHO WILDLIFE FEDERATION AT ANNUAL CONFERENCE IN BOISE, IDAHO, JANUARY 15, 1956

Whereas Senate Document 51, a report of the Army engineers on the middle Snake River and its tributaries, does distort and withhold facts in relation to

fish and wildlife problems connected with building dams on the Clearwater drainage of Idaho; and

Whereas without full and complete information on which to base its judgment, it is impossible for the Congress to arrive at a considered and accurate appraisal of the results of the construction of these dams; and

Whereas the Army engineers have in this instance signally failed as a fact-finding body for the Congress: Therefore be it

Resolved, That all information in Senate Document 51 be held prejudiced, inaccurate, and incomplete, and that the Public Works Committee of the United States Senate disregard the document, and that a copy of this resolution be forwarded to said committee.

RESOLUTION PASSED BY THE IDAHO WILDLIFE FEDERATION AT ITS ANNUAL MEETING ON JANUARY 15, 1956

Be it resolved, That the Idaho Wildlife Federation favors construction of dams in the Hells Canyon reach of the Middle Snake and at Mountain Sheep and Pleasant Valley sites, provided:

(*a*) Damage during and after construction to fish and wildlife is minimized insofar as economically possible.

(*b*) Studies to determine the effect of these dams on fish and wildlife are financed by the construction agencies.

(*c*) Restitution for any damages to fish and wildlife is provided to the affected States.

(*d*) No water is diverted from the Salmon River at any time in the future.

(*e*) Recreational facilities of the projects are developed.

RESOLUTION PASSED AT THE 18TH ANNUAL CONVENTION, NATIONAL WILDLIFE FEDERATION, CHICAGO, ILL., MARCH 11, 12, AND 13, 1954

Whereas dams are now proposed for construction at Bruces Eddy and Penny Cliffs on the Clearwater River in northern Idaho which will destroy important runs of anadromous fishes, as well as resident trout populations, and inundate a major part of critical winter ranges of one of the Nation's largest elk herds; and

Whereas the reservoirs of the Penny Cliffs Dam would extend some 6 miles into the Selway-Bitterroot wilderness area in the national forest: Now, therefore, be it

Resolved, That the National Wildlife Federation reaffirm its traditional policy in the specific case of the above mentioned Clearwater dams; and be it further

Resolved, That further investigation be made of these proposed projects by the Fish and Wildlife Service, United States Forest Service, and Idaho Department of Fish and Game to determine their effect on the fish, wildlife, wilderness area and recreational values, and that in future planning and investigation, fish, wildlife, and recreation interests be given full and equal stature together with the States and construction agencies, whether private or public, to the end that the vital resources of this area be protected from ill-advised destruction from which there can be no recovery; be it still further

Resolved, That final consideration of the proposed projects be postponed until the results of the above recommended investigations on the fish, wildlife, and recreational resources of the Clearwater River are available.

Mr. BRANDBORG. Other national conservation organizations—including the Izaak Walton League, the Wildlife Management Institute, the Sierra Club, the Wilderness Society, the National Parks Association, the Outdoor Writers Association of America, Citizens Committee on Natural Resources, and the National Campers & Hikers Association have opposed the current plans for these projects.

I would like to request also that excerpts from my testimony before the Subcommittee on Public Works of the Senate Appropriations Committee, as shown on the statement before you, be included in the record to show some of the biological considerations which support the position of the conservation organizations on these projects.

Senator NEUBERGER. Without objection, it is so ordered.
(Excerpts of testimony referred to follow:)

EXCERPTS FROM A STATEMENT ON THE PROPOSED BRUCES EDDY AND PENNY CLIFFS DAMS BY STEWART M. BRANDBORG, ASSISTANT CONSERVATION DIRECTOR, NATIONAL WILDLIFE FEDERATION, BEFORE THE SUBCOMMITTEE ON PUBLIC WORKS OF THE SENATE APPROPRIATIONS COMMITTEE, MAY 10, 1956

I should like also to review the facts which support the position of the National Wildlife Federation and the other conservation groups which have opposed these projects. This opposition is offered by the leading conservation organizations of the country as well as those of Idaho and the Northwest.

It should be pointed out at this time that the current budgetary grouping of the unauthorized Bruces Eddy project with the John Day and Green Peter projects, for which authorization and appropriations have been granted by past Congresses, does not appear to be consistent with policies of the Congress. Bruces Eddy has not been authorized by Congress and no funds have been appropriated for it in the past.

The Clearwater River, draining an area of over 9,600 square miles, contains an unequalled expanse of wilderness country which provides habitat for thousands of elk, mule and white-tailed deer, herds of mountain goats and remnant bands of bighorn sheep, large populations of upland game and songbirds, black bear, coyote, cougar, marten, and many other animals of the northern Rocky Mountains. Its hundreds of miles of dashing crystal-clear mountain streams are inhabited by native trout as well as steelhead, the giant sea-run rainbow that migrate from the Pacific to spawn in waters that flow from snowfields of the high Bitterroot Range.

The Clearwater elk herd of more than 25,000 animals, is one of the largest, if not the largest in the United States. In excess of 4,000 elk, as well as hundreds of deer, are harvested here each fall. Four thousand and seven hundred elk were taken by some 17,000 hunters in 1954, a number that represents approximately 10 percent of the total harvest of this big game animal in the United States. Each year hunters spend more than $3 million on their visits into Clearwater ranges from which they take meat that is valued at more than three-quarters of a million dollars. Outfitters and guides, who serve these visitors, do more than $200,000 worth of business annually.

Winter food shortages limit the increases of elk and deer in the Clearwater country. These would be made more critical as a result of the flooding of thousands of acres of low valley ranges by the Bruces Eddy and Penny Cliffs Reservoirs. It is here that big game concentrates when winter snows cover the high mountain ranges. The loss of the low wintering areas, coupled with the obstruction of elk migration routes, would result in excessive die-offs from starvation during hard winters. Estimates by the Idaho Department of Fish and Game and the United States Forest Service show that several thousand elk and deer use ranges which would be inundated by the waters of the proposed impoundments.

Starvation is not new to the big-game herds of the Clearwater. Hard winters have caused losses of thousands of animals from critical food shortages. In the winter of 1948–49 heavy snows took a toll of between two and three thousand elk and hundreds of mule and white-tailed deer.

Bruces Eddy Dam would flood 49 miles of the canyon on the North Fork of the Clearwater, approximately 5 miles of the Little North Fork and many miles of lower tributary canyons to leave even less food to carry these big-game animals through the critical periods. Penny Cliffs Reservoir would flood a greater area which would include the lower canyons of the Lochsa and Selway Rivers. No method is known for replacing the natural foods provided by these valley ranges that are so vital to the winter survival of the herds.

The dam at Bruces Eddy would be 570 feet high; the Penny Cliffs project would rise 590 feet above the riverbed. Together they would form an almost complete obstruction to steelhead trout and Chinook salmon that migrate from the ocean into spawning waters of the Clearwater. There are no practical methods for getting fish over dams of this height. Such structures would also affect the habitat of the native trout in these swift-flowing streams.

Both of these rivers are occupied by large populations of steelhead trout. By making thes spawning waters inaccessible, the present and potential fish production of the entire Clearwater drainage would be seriously impaired. Studies of the Clearwater have shown that its potential for production of both steelhead

and salmon is tremendous and that a steady increase has been recorded in the number of migrant steelhead entering it since the construction of adequate fish passageways over the low dam at Lewiston. Counts of migrant fish at these ladders have shown an increase from 3,693 in 1950 to 13,971 in 1955. Chinook salmon runs, which were destroyed before the installation of fish ladders at the low Lewiston Dam, have also shown some indications that they may be reestablished.

At present, more than 60 percent of the Columbia tributaries are blocked to migrant steelhead and Chinook salmon. Each new dam on the main Columbia and Snake Rivers, including the Ice Harbor and John Day projects, serve as further obstructions to these migrants on their trips between the ocean and spawning beds. If we start now to block off the headwater spawning streams of the Clearwater River by building impassible Bruces Eddy and Penny Cliffs Dams, we will have cut off two of the last remaining areas where clear-running mountain streams provide breeding waters of the type required by these highly valued searun fish. Another death blow will have been dealt the dwindling commercial fisheries of the Columbia River system, now producing more than $17 million worth of harvestable steelhead and Chinook annually.

In addition to its great contribution to commercial take, the Clearwater provides unequaled sport fishing for both resident trout species and steelhead. In 1954 over 132,700 fishing trips were made along its waters, with fishermen taking some 547,000 trout and 8,200 steelheads. Last year 5,200 angler days were spent by fishermen who visited the North Fork to take over 42,000 trout. Of these, 60 percent were spawned by steelhead which would be completely eliminated by the Bruces Eddy Dam. A comparable loss to fisheries would result from the Penny Cliffs project.

In addition to obstructing natural fish movement and destroying a major part of the big-game ranges of the lower Lochsa and Selway Canyons, the Penny Cliffs Reservoir would extend for 6 miles into the Selway-Bitterroot primitive area, one of the most outstanding areas of wild country in the United States. If our wilderness system is to be perpetuated in this country, areas such as this one cannot be subjected to disfigurement by invading reservoirs.

Also to be lost, if this dam were to be built, is the water-grade Lewis-Clark Highway. Constructed at a tremendous public expense along the Middle Fork and Lochsa Canyons, this scenic drive is now near completion.

What would artificial reservoirs created by the dams offer to compensate for this loss of scenic grandeur, big-game ranges, and some of the best fish-producing streams of the country? Scarred and denuded canyons, steep-walled and silt-covered slopes that would be exposed by the extreme water fluctuations. The natural beauty of these precipitous mountain valleys would be destroyed along with the dense growths of evergreens and shrubs which are staple winter foods of big game. The area would no longer be known as an attraction to the thousands of recreational users who visit it in numbers that increase with each passing year.

The Idaho Department of Fish and Game, the United States Fish and Wildlife Service, the Idaho Cooperative Wildlife Research Unit, and the Oregon State Game and Fish Commissions have indicated that the Bruces Eddy and Penny Cliffs Dams would have devastating effects on wildlife and recreational resources. They have urged that biological studies, now in progress, be completed before any projects are authorized on the Clearwater River. Such studies would serve to demonstrate the effects of these dams on fish and game and the importance of millions of dollars of income that accrue from recreational uses of this wilderness. Once destroyed, these values are irreplaceable, and approval of plans to build Bruces Eddy, Penny Cliffs, or any one of the several other dams proposed for construction on the Clearwater River, threaten to preclude completion of a comprehensive and fully integrated program of water development for the Middle Snake River Basin.

Mr. BRANDBORG. The proposals for construction of Clearwater dams at Bruces Eddy and Penny Cliffs, as offered separately by the Corps of Engineers and the Pacific Northwest Power Co. and under the current "partnership" plan, have been made in the absence of adequate studies and appraisals by appropriate State and Federal agencies of the importance of wildlife and recreational assets of Clearwater Basin. We feel that it is essential, in order to protect the interests of the 35

million people of this country who hunt and fish, and the tens of millions who enjoy other outdoor pursuits in natural areas, to weigh these values along with those accruing from flood control, hydroelectric production, and navigation.

Alternate sites should be selected for these water-development projects within the upper Columbia River system to prevent loss of irreplaceable recreational and esthetic values. There are few places in the United States where one can travel in wilderness country which compares to that found within the Clearwater country and few areas offer comparable combinations of big game, fish, and the other species of wildlife that are indigenous to this northern Rocky Mountain region of the United States.

While we joint the people of this region in recognizing the need for flood control on the main Columbia River and its tributaries, we feel that it is entirely possible to provide such protective measures without destroying the recreational assets that are found on the Clearwater and Salmon Rivers, within Glacier National Park, and the other areas of wilderness and undeveloped country where vast wildlife and recreational resources are still to be enjoyed. There is need for comprehensive planning of river development programs which will place emphasis on the consideration of all resource values. Nowhere is there greater evidence of the need for this than on the Clearwater drainage of the Middle Snake River where private and Federal agencies have minimized and misrepresented the present and potential benefits from wildlife and recreation. We cannot anticipate satisfaction from river development programs which are the product of continued conflicts between private and public dam-building interests which have battled relentlessly for authorization to develop these water resources in the absence of a comprehensive, long-range plan. Such an approach can only result in the misuse and waste of the resources of this rich basin.

As conservationists, we stand firmly opposed to shortsighted plans for river developments which will allow the desecration of wildlife, wilderness, and recreational areas. It is our belief that it is unnecessary to sacrifice these irreplaceable values in order to obtain the anticipated benefits of river development. Thorough investigation and careful planning can point the way to both the development of our water and the careful protection of these priceless assets which are such an important part of our American heritage.

It has been a privilege to appear here today. Thank you.

Senator NEUBERGER. Thank you very much, Mr. Brandborg.

Senator Laird, do you have any questions?

Senator LAIRD. No questions.

Senator NEUBERGER. I would like to ask you several questions very briefly. Our time is limited, and I know yours is limited.

I want to ask you specifically the stand of the National Wildlife Federation if, indeed, it has any, on a number of specific power, storage, flood-control, navigation, irrigation sites in the Pacific Northwest.

How does your organization stand on Bruces Eddy on the North Fork of the Clearwater River?

Mr. BRANDBORG. Our organization is opposed to Bruces Eddy Dam as it is presently offered for development of the North Fork. We feel that a high dam of these specifications would jeopardize and destroy

many of the irreplaceable recreational values that we have in the Clearwater country.

Senator NEUBERGER. Thank you very much.

On the Penny Cliffs Dam, also on the Clearwater?

Mr. BRANDBORG. We have the same attitude toward that project. As you know, dams of these heights would completely block the migrations of anadromous fish, particularly the steelhead trout, which have shown great potentialities for reestablishing themselves and which have recovered to a considerable extent within the last few years from the effects of the dam at Lewiston.

Senator NEUBERGER. How does your organization stand on proposed dams on the Salmon River between its headwaters and its confluence with the Snake River?

Mr. BRANDBORG. We are on record as opposing dams on the Salmon River since it is of such great importance to the fisheries and the wildlife resources of the Middle Snake River and the entire Columbia Basin.

Senator NEUBERGER. What is the stand of your organization on the proposed Libby Dam on the Kootenai River in Montana?

Mr. BRANDBORG. To my knowledge we have not taken any specific action on that project. To my knowledge, we have not opposed that project.

Senator NEUBERGER. What is your stand on the proposed Hells Canyon high dam on the Snake River?

Mr. BRANDBORG. We look at Hells Canyon as one of many projects on the other tributaries of the Middle Snake River and Columbia River system which might possibly be developed as an alternative to the proposed projects on the Clearwater.

Senator NEUBERGER. Has your organization taken any stand or does it have any stand on the sites on the upper Columbia River which are not of the international boundary, such as Arrow Lakes and Mica Creek which are within British Columbia?

Mr. BRANDBORG. I do not believe we have taken any position on those proposals and plan.

Senator NEUBERGER. You neither oppose nor are in favor of them?

Mr. BRANDBORG. That is my understanding.

Senator NEUBERGER. That is all the questions I have unless you have some questions, Mr. Mapes.

Thank you very much, Mr. Brandborg, for coming here today and giving us the benefit of your views and the views of your organization.

Mr. BRANDBORG. I might say, Senator, if I may, that the Clearwater country is well known to me. I was raised in the Clearwater drainage, and I have also worked there as a biologist with the Idaho Department of Fish and Game. I feel that I am in a position, as one who has traveled over this country, to speak of its recreational resources.

Senator NEUBERGER. It is one of our favorite places, too. We have been all through it. Thank you very much.

Our next witness will be Mr. Howard Zahniser, representing the Wilderness Society.

Mr. Zahniser.

STATEMENT OF HOWARD ZAHNISER, EXECUTIVE SECRETARY, WILDERNESS SOCIETY

Mr. ZAHNISER. Mr. Chairman, my name is Zahniser and my first name is Howard. I am executive secretary of the Wilderness Society and editor of the Living Wilderness. My headquarters are here in Washington, D. C., at 2144 P Street NW.

Mr. Chairman, I have heard the excellent statement that Mr. Brandborg has presented, and I would subscribe to that statement and to the recommendations included within it.

At the hearing on the Bruces Eddy Dam on March 19 our assistant executive secretary, Mr. Michael Nadel, presented a brief statement which supplements the remarks that Mr. Brandborg made and the papers to which he referred, and I should be glad to have this included in the record here at this point, if that is agreeable.

Senator NEUBERGER. Without objection, that will be done.

(Statement of Mr. Nadel follows:)

A STATEMENT IN BEHALF OF THE WILDERNESS SOCIETY BY MICHAEL NADEL, ASSISTANT EXECUTIVE SECRETARY, ON THE PROPOSED BRUCES EDDY DAM, PRESENTED TO THE HOUSE APPROPRIATIONS SUBCOMMITTEE ON PUBLIC WORKS, WASHINGTON, D. C., ON MARCH 19, 1956

My name is Michael Nadel. I appreciate the opportunity of presenting a brief statement in behalf of the Wilderness Society, of which I am assistant executive secrettary.

I should like, first, to recall that in February 1954, Dr. Olaus J. Murie, president of the Wilderness Society, was heard by the Board of Engineers for Rivers and Harbors in Washington, D. C., on the proposed construction of a Bruces Eddy Dam on the north fork of the Clearwater River in Idaho.

Dr. Murie, a foremost authority on the subject of elk, stated that the Bruces Eddy impoundment would flood canyons in which is located the crucial winter range of the elk. On this winter range is produced the browse species which elk require in order to subsist.

Dr. Murie also called attention to the destructive effect this engineering structure would have upon steelhead trout and salmon resources by inhibiting their migratory runs and obliterating spawning areas.

In addition to these unhappy results, thousands of acres of forest land would be flooded and lost forever.

Against this background we should now consider the following statement by Brig. Gen. Louis H. Foote, division engineer for the North Pacific division of the Army Corps of Engineers, which was reported in the December 3, 1955, issue of the Lewiston Tribune, in connection with the project for which you are now considering appropriations:

"There is no such thing as an ultimate and complete plan, however. If our plan is valid for 12 to 15 years, we will have done a remarkable job."

Our appreciation of such candor does not lessen the sense of amazement at such calm acceptance of irrevocable annihilation of needed scenic, wildlife, recreational, and economic resources in order to build a commodity whose life will be only 12 to 15 years.

In the view of any prudent planner for public works, this cannot be considered as being in the nature of an investment in the interest of the people of the Nation. Dr. Murie observed that farsighted planners must give consideration to all the values which are vital to our welfare. There are broad public interests which have the first claim, in our natures and in our social and economic needs, upon especially meaningful natural areas and resources. Let us not short circuit our needed resources by being shortsighted.

It would be a worthy thing for the engineers to get together with other agencies that represent the consumers of the Nation. There need be no real conflict, nor controversy, if all the needs are studied and put in genuine perspective.

We must support our cooperating wildlife-conservation groups in opposing the construction of Bruce's Eddy Dam on the ground that it would destroy irreplaceable natural resources. A dam to meet suitable purposes of the proponents

should be constructed on alternative sites where there will be less damage to our already diminished resources.

Mr. ZAHNISER. I have no prepared statement for you this morning. I have been greatly interested in the Columbia River. I have studied the earlier work on the Columbia River Basin. I have read with interest your recent report.

My interest in appearing here is to encourage and recommend further the broadest possible planning of our resources development. I make that recommendation from the point of view of those who are concerned with the preservation of some areas of our country in an unspoiled natural condition and with the maintenance of as much of it is possible in a condition that will encourage the development of the wildlife that we all enjoy in recreation.

Our country is such and our population is expanding in such a way, our mechanizing processes are going along at such a rate, that it looks as though we shall have none of the country left for these purposes except those places that we deliberately plan for. We cannot expect the accidents of history longer to maintain parts of our land virgin and undeveloped. So the very prospect of this very deep interest of all the American people—I know nothing more popular than the preservation of these values that we are here concerned with—but the very prospect of it in the future is dependent on planning.

Over and over again in the 10 years that I have been intensively working in this field I have come into controversies, and nearly every one of them has been a controversy that could have been avoided had all involved taken a broader view early. I have never yet contended with anybody who opposed the objective that I was representing. The difficulty in seeing that objective realized was the difficulty of avoiding some other program. So the earlier that we can look and the broader we can look at these programs the better our opportunities are for accomplishing all our objectives.

That seems to be a particularly pertinent thing in the upper Columbia River Basin. I have the same attitude toward the Bruces Eddy Dam that Mr. Brandborg expressed. With regard to the Penny Cliffs Dam I am even more sharply concerned because the Penny Cliffs Dam would do two things in addition to those which Mr. Brandborg referred to. It would back water some 6 miles into one of the dedicated areas of wilderness within our national forests, the Selway-Bitterroot primitive area. It also would back water up one of the most wonderful scenic highway areas that we have. Our hope of preserving areas of wilderness is, in part, dependent on our meeting highway recreation needs outside the wilderness areas. So at one time the Penny Cliffs inundation would destroy a portion of the wilderness and also take away a developed recreational opportunity along the Lochsa. It looks to us as though both the Penny Cliffs Dam and the Bruces Eddy Dam could be avoided with a broad view, with maximum development of resources elsewhere.

I see this problem extending across the border into Canada. I believe, as I recall, some 60 million acre-feet of the water of the Columbia comes from Canada. Of the total of about 180 million acre-feet, more than 60 million comes out of Canada. So here is a great opportunity there for basin development in international cooperation.

The boundary of Canada has never been an obstruction to any of us inhabitants of North America. I feel that here is an opportunity to take the broadest possible view in meeting our needs which include those for the preservation of some areas in their natural condition.

That is the reason I was interested in coming here—to express that philosophy and to encourage work along that line which I know you have underway and for which we offer support.

Senator NEUBERGER. Thank you, Mr. Zahniser.

Are there any questions, Senator Laird?

Senator LAIRD. No.

Senator NEUBERGER. Senator Dworshak.

Senator DWORSHAK. Just one question. I don't want to prolong this matter. I didn't hear the first few minutes of your testimony, but in reference to the Bruces Eddy and Penny Cliffs, surely you realize in your organization that nobody is proposing to develop Penny Cliffs Dam at this time.

Are you aware of that and that it is entirely in a different category than Bruces Eddy Dam?

Mr. ZAHNISER. I understand it is in a different category. I see it on the maps.

Senator DWORSHAK. I mean to this extent: When we talk about proposed dams on the Clearwater we may talk about Bruces Eddy, but that doesn't necessarily mean that we are going to tie in Penny Cliffs and try to construct the two of them concurrently. We could undertake one. There seems to be general agreement that Bruces Eddy would fit in better with less detrimental effect upon fish and wildlife than Penny Cliffs, so the emphasis is being placed on Bruces Eddy. I wonder if you knew that.

Mr. ZAHNISER. Yes. My sharper concern is with Penny Cliffs because of two factors. I don't know whether you were here when I was speaking of those factors. I am sorry I didn't know you were here, Senator Dworshak, or I would not have sat with my back to you. There are two aspects of the Penny Cliffs Dam, added to the others. One is its inundation of a portion of the Selway Bitterroot primitive area; the other is its inundation of the Lewis and Clark scenic highway.

Senator DWORSHAK. I think you said all these disagreements and controversies could be resolved if we took a broad, rather tolerant viewpoint.

Mr. ZAHNISER. That is my faith.

Senator DWORSHAK. I share with you and agree with you on that point. All I want to ask you is whether you know that more than a year ago the Federal Fish and Wildlife Service initiated an extensive and thorough study which will probably take as much as 3 years of the fish and wildlife resources in the Middle Snake area which embraces the Clearwater watershed and also that insofar as Idaho is concerned that the Idaho State Game Commission is cooperating with the Federal agency. Obviously before any determination can be made to undertake construction of Bruces Eddy Dam there will have been afforded ample opportunity to scrutinize these reports made by these fine agencies to determine what the potential effects of that dam will be upon the fish and wildlife in the area. Are you aware of that?

Mr. ZAHNISER. Yes; I did know of that study, and I am looking forward to the results of it eagerly. Furthermore, I am greatly pleased at what you say, because we have been deeply concerned recently with word that we have heard of efforts to get the Bruces Eddy Dam authorized immediately, and even to get appropriations made for work on it. To hear you say that that is going to be postponed until the conclusion of these basic studies is greatly encouraging.

Senator DWORSHAK. Let's eliminate what appears to be another misunderstanding. The Army Engineer Corps cannot undertake engineering work, preconstruction work on Bruces Eddy until first it has been authorized, but when it has been authorized by a legislative committee, the Public Works Committee in this case, then the Engineers can proceed but they have indicated it will take a minimum of 2 years to complete their preconstruction work.

So when you talk about having a dam authorized, again I must emphasize that if the surveys and engineering work which will be done by the Army Engineer Corps are completed it will take 2 years before we are able to determine what shall be done so far as actual construction of Bruces Eddy is concerned.

Did you realize that?

Mr. ZAHNISER. Yes.

Senator DWORSHAK. Then it will take at least 2 years before anything can be done.

Mr. ZAHNISER. My feeling, Senator Dworshak, is that as a matter of national policy we should not commit ourselves to that use of that area until we have this basic data that you referred to.

Senator DWORSHAK. Are you implying that you are even against the authorization of it?

Mr. ZAHNISER. Yes.

Senator DWORSHAK. Then you are setting up a roadblock because you can't have these studies made until the dam is authorized, but its mere authorization doesn't mean that construction is inevitable. It simply means that the Army Engineer Corps is authorized to proceed for 2 years or longer on these surveys and studies and authorizations. I thought you had a misunderstanding. Authorization does not carry with it the construction of the dam.

Mr. ZAHNISER. I have been told at other times: "When you should have appeared, Mr. Zahniser, to discuss these things was when the authorization was in question rather than waiting until we have invested a lot of time in developing plans and then coming and telling us about the fish and wildlife."

Senator DWORSHAK. I will ask you a question at that point. If you don't authorize a dam and the Army engineers don't undertake an extensive and thorough survey, then how will you compile the data upon which an intelligent conclusion can be based as to the actual construction of a dam?

Mr. ZAHNISER. I would approve the authorization of a study to gather data on it.

Senator DWORSHAK. You can't get a study without the authorization, my friend. That is what I am trying to tell the members of your organization and these others.

This morning I received several vitriolic telegrams condemning me because I am trying to bring this to a showdown, not to force con-

struction of Bruces Eddy upon my State or the Columbia River Basin, but merely to follow the only procedure which we can which will enable the Army Engineer Corps to undertake this extensive preconstruction study. But the members of these wildlife groups are confusing the authorization of a dam with the actual construction of a dam.

Mr. ZAHNISER. There is no vitriol in my nature, Senator Dworshak.

Senator DWORSHAK. I didn't refer to you. I said that I received several this morning in my office. I didn't mean you, sir.

Mr. ZAHNISER. I am confronting the same frustration, apparently, that you are, for we do not wish to participate in the authorization of a dam that we think may not be properly built. We certainly don't want to undertake studies to find out how to do something that should not be done.

Senator DWORSHAK. How do you determine whether it should be done or not be done until you have completed these studies? Do you arrive at conclusions and just grab these data out of the air? That is what is being done now. I want to overcome that so we can proceed in an orderly fashion.

Mr. ZAHNISER. I think we have the same basic objective in realizing that, if we are going to have a sound overall program and realize our various objectives, we are going to have to base our programs on careful studies.

Senator DWORSHAK. Not on propaganda and misinformation and misunderstanding, which today seem to be the basis upon which too many persons base their conclusions concerning Bruces Eddy and development in that part of the State.

Senator NEUBERGER. The Chair would just like to say he has been quite interested in this discussion of Bruces Eddy. I would wish that those on this side of the table would have the same attitude toward Hells Canyon that Senator Dworshak has toward Bruces Eddy, that you would allow us to authorize Hells Canyon so we might have more comprehensive studies on Hells Canyon. I have heard all kinds of studies cited against authorizing Hells Canyon, which has not yet been authorized. I would like to see the same very tolerant attitude manifested toward Hells Canyon. Let's authorize the high dam at Hells Canyon and get further study.

Senator DWORSHAK. Mr. Chairman, it is my understanding that the Bureau of Reclamation, which has supervision over Hells Canyon, has already completed most of these studies. I don't know whether that information is available at this point. Does Mr. Nelson or Mr. Straus or someone know to what extent the studies have been completed?

Senator NEUBERGER. It is interesting to me that there is sauce for the goose but not for the gander; that we have to authorize Bruces Eddy before we can have studies of Bruces Eddy, but that we should not authorize Hells Canyon where evidently we already have ample studies. I am very new here, but I don't understand the difference.

Senator DWORSHAK. Let the record speak for itself. I am sure that I can't tell you how far the studies have been made on Hells Canyon. I think there has been considerable data compiled. Can you tell us, Mr. Nelson, without going into detail?

Mr. ELMER K. NELSON (professional staff member). I think the Bureau has made what they call their preliminary reconnaissance

studies of Hells Canyon. I think that has been presented to this committee and to the Federal Power Commission on the same basis. I think, that the Army engineers have submitted studies on some of their dams. I think it is fairly comprehensive.

I don't know to what extent they have done preconstruction investigations, but I think they have gone far enough to prepare some estimates of cost.

Senator NEUBERGER. May I ask you a question, Mr. Nelson? If I am not mistaken, the recommendation for both Hells Canyon and Bruces Eddy is in the so-called 308 report of the Army engineers. Is that right or is that wrong?

Mr. NELSON. I think that is right.

Senator DWORSHAK. That is only partially correct. I think possibly Hells Canyon was, but the Army engineers were completely unaware of the Bruces Eddy Dam when that study was made. Is that correct?

Senator NEUBERGER. I just do not know. The only thing is you are talking about the Army engineers at Bruces Eddy and you say that we have to authorize Bruces Eddy so they can complete their studies. But it was the Army engineers who originally recommended Hells Canyon, so why don't we authorize Hells Canyon so they can complete their studies of Hells Canyon?

Senator DWORSHAK. Mr. Chairman, I can't give you the specific information, but you know, I am sure, or have heard reports, that the Bureau of Reclamation and the Army engineers apportioned the different sections of the Snake River. I think Pittsburgh Landing or some point on the river above the confluence of the Salmon and the Snake is the point above which the Bureau of Reclamation supervises all project construction, while the Army engineers supervise below Pittsburgh Landing and the tributaries like the Clearwater. That is a decision in the making of which I had no voice, and I think that is the situation.

Senator NEUBERGER. Are we to understand, then, that the policy confronting the Congress is this: That where it is a Bureau of Reclamation dam you don't need to authorize it to get a study, but where it is an Army engineer dam you have to authorize it first before you can get a study.

Senator DWORSHAK. No, I wouldn't say that. That isn't my approach. It is my understanding that enough work has been done and hearings were held before this committee, before the House Interior Committee—I am sure of that.

Senator NEUBERGER. On Hells Canyon.

Senator DWORSHAK. On Hells Canyon. So we have had extensive hearings during the past 6 or 7 years. That same situation does not obtain so far as Bruces Eddy is concerned because it was only 3 years ago when the Army engineers got their initial funds with which to undertake even any reconnaissance or any work on the Clearwater. So they are not in the same category.

Senator NEUBERGER. May I ask you this, Senator Dworshak: Would it not be possible for the same hearings to be held by the Public Works Committee without first authorizing Bruces Eddy? I am a member of the Public Works Committee, and while I am only a very low ranking member so far as seniority is concerned, I would use what

little influence I have to undertake hearings without first authorizing the construction. Why don't we have the same rule apply to Bruces Eddy as has been applied to Hells Canyon?

Senator DWORSHAK. Mr. Chairman, I am certainly not going to set myself up as the judge as to what should be done with reference to either of these projects. I do know that a year ago the Army engineers sent a report to your committee recommending that both Bruces Eddy and Penny Cliffs be constructed, because they considered especially Bruces Eddy as being one of the most outstanding multiple-purpose sites in the entire West. I can't tell you definitely what was done by the Bureau of the Army Engineer Corps which, as I recall, did do some survey work on Hells Canyon Dam before that agreement was reached between the two Federal agencies. I am not sure whether either the Bureau or the Army Engineer Corps had recommended a high Hells Canyon Dam. I would have to check the record on that, because it goes back several years.

Senator NEUBERGER. You would have no objection if we put in the record at this point the Army engineers' recommendations of Bruces Eddy to the Public Works Committee and the Army engineers' recommendations of Hells Canyon in the 308 report?

Senator DWORSHAK. No.

Senator NEUBERGER. Without objection, those will be obtained for the record.

(The material referred to follows:)

[Excerpts from S. Doc. No. 51, 84th Cong., 1st sess.]

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY,
Washington, D. C., June 1, 1955.

Hon. DENNIS CHAVEZ,
Chairman, Committee on Public Works,
United States Senate, Washington, D. C.

DEAR MR. CHAIRMAN: I am transmitting herewith a report dated April 25, 1955, from the Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on Middle Snake River, Snake River, and tributaries, Wyoming, Idaho, Oregon, and Washington. This investigation was requested by a resolution of the Committee on Public Works, United States Senate, adopted on October 5, 1951. The Bureau of the Budget has advised that while there would be no objection to the submission of the proposed report of the Chief of Engineers to the Congress, authorization for complete Federal development of the Bruces Eddy and Penny Cliffs projects would not be in accord with the program of the President until the possibilities of local participation have been fully explored. The complete views of the Bureau of the Budget are contained in the attached copy of its letter.

In view of the fact that a large proportion of the benefits of the projects consist of flood-control benefits and of benefits to downstream Federal dams, the Chief of Engineers considers that construction of either project as a whole is unlikely to be financially profitable for any license unless some form of Federal financial participation is authorized.

A partnership arrangement, under which the Federal Government would build the dam and non-Federal interests the power facilities, could be developed so as to conform generally to previously proposed partnership plans. This would be accomplished by legislation essentially similar to H. R. 4662 for the Cougar and Green Peter projects. Under this arrangement, the participating company would finance the entire cost of the project allocated to production of power at site. There is one basic difference between the Cougar and Green Peter projects and the Clearwater Basin projects now under consideration. The operation of the latter must be coordinated closely with downstream plants in order to obtain the maximum advantage for the region as a whole, in view of the very large downstream power benefits which can be obtained. This relationship requires

a suballocation of allocated power costs for the Bruces Eddy project between at-site power and Federal downstream power. Although the methods for making this type of allocation are not well established, this difficulty can be overcome. Operational arrangements will be required through which the operation of this project will be coordinated with other dams and reservoirs in the interest of the region as a whole.

It is believed that the projects as recommended by the Chief of Engineers should be authorized at an early date. It is recommended that this be accomplished by means of a partnership arrangement, preferably one similar in principle to H. R. 4662, as outlined in the preceding paragraph.

Sincerely yours,

ROBERT T. STEVENS,
Secretary of the Army.

COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington 25, D. C., May 12, 1955.

The honorable the SECRETARY OF THE ARMY:

MY DEAR MR. SECRETARY: This is in reply to Assistant Secretary Roderick's letter of April 25, 1955, submitting a copy of the report of the Chief of Engineers on the Middle Snake River, Idaho, Oreg., and Wash., requested by resolution of the Committee on Public Works, United States Senate, adopted on October 5, 1951.

The Chief of Engineers recommends authorization for Federal construction of Bruces Eddy project on North Fork, Clearwater River, and Penny Cliffs project on Middle Fork, Clearwater River, both in Idaho, at an estimated cost to the United States for $320,351,000. Annual benefits, carrying charges, and benefit-cost ratios for the two projects are stated to be as follows:

Item	Bruces Eddy	Penny Cliffs
Benefits:		
Flood control	$1,725,600	$2,812,800
Navigation	537,000	271,200
Power	8,175,000	10,895,000
Recreation	45,000	55,000
Total	10,482,600	14,034,000
Annual carrying charges	5,209,000	8,151,000
Benefit-cost ratio	2.01	1.72

On the basis of the information contained in the report, it appears that about 70 percent of the costs of the two projects would be allocated to power and 30 percent to flood control and navigation.

Under date of August 18, 1954, the Federal Power Commission issued a preliminary permit to the Pacific Northwest Power Co. for two projects in the Clearwater River Basin which, it is understood, would accomplish substantially the same purposes as the projects recommended by the Chief of Engineers. Subsequently, on December 31, 1954, at the request of the applicant the preliminary permit was amended to exclude the Penny Cliffs development. The order stated that the investigation thus far conducted under the preliminary permit showed that the public interest would best be served by development of other hydroelectric sites prior to the development of the Penny Cliffs site. The applicant noted that there were indications that the proposed Penny Cliffs development might have an effect on the wildlife and fish in the area and that an adequate investigation to determine the effect of this impact might occupy a period of time in excess of that allowed by the preliminary permit or any legal extension thereof.

On the basis of this information it appears that non-Federal interests have expressed a willingness to develop the water resources of these two sites under the provisions of the Federal Power Act and should, in the light of the partnership policies of the President, be encouraged to do so. Under the application covered by the existing preliminary permit the Pacific Northwest Power Co. contemplates building the entire Bruces Eddy project. When the fish and wild-

life proposals have been resolved it may also be interested in building the Penny Cliffs project. If neither of these proposals prove feasible after detailed investigation, it may be possible to adopt the alternative of Federal construction of the dams with installations of the power facilities by non-Federal interests. It is believed that careful consideration should be given to these facts in your submission of the report to the Congress.

Accordingly, while you are advised that there would be no objection to the submission of the proposed report of the Chief of Engineers to the Congress, authorization for complete Federal development of the Bruces Eddy and Penny Cliffs projects would not be in accord with the program of the President until the possibilities of local participation have been fully explored.

Sincerely yours,

ROWLAND HUGHES, *Director.*

COMMENTS OF THE PACIFIC NORTHWEST POWER CO.

PACIFIC NORTHWEST POWER CO.,
Spokane, Wash., May 19, 1955.

Col. CHARLES D. MCDANIEL,
Corps of Engineers, Executive Offices, Portland, Oreg.

DEAR COLONEL MCDANIEL: In answer to your letter of May 16, the Pacific Northwest Power Co. is now pursuing studies on Bruces Eddy project under terms of Federal Power Commission Preliminary Permit No. 2147.

If the United States desires to authorize this project and the Penny Cliffs project for Federal construction, because of the large river and flood-control features involved we would desire and recommend a provision in the authorization providing a reasonable period of time after authorization and completion of cost, by the Chief of Army Engineers, to apply for a Federal Power Commission license to build, own, and operate the at-site power facilities and to contract to make reasonable payment for "falling water" to compensate the Government for its investment in dam and reservoir properly allocated to at-site power.

We believe it would assure earliest possible construction with minimum investment by the Nation's taxpayers.

Will be glad to discuss matters more in detail with you, if you so desire.

Very truly yours,

K. M. ROBINSON, *President.*

MIDDLE SNAKE RIVER, SNAKE RIVER AND TRIBUTARIES, WYOMING, IDAHO, OREGON, AND WASHINGTON

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., April 25, 1955.

Subject: Snake River and Tributaries, Wyoming, Idaho, Oregon, and Washington.
To: The Secretary of the Army.

1. I submit for transmission to Congress my report with accompanying papers on the Middle Snake River, Snake River and tributaries, Wyoming, Idaho, Oregon, and Washington in response to resolution of the Committee on Public Works of the United States Senate, adopted October 5, 1951, requesting a review of the report printed in House Document 531, 81st Congress, 2d session, and other reports on the Columbia River and tributaries to determine whether any modification of the recommendations contained therein would be advisable at this time with particular reference to a dam at the Mountain Sheep site or other sites on the Snake River. In recognition of the mutual interest of the Department of the Army and the Department of the Interior in water-resource development of the Pacific Northwest, it was agreed between the Secretary of the Army and the Secretary of the Interior, that for the purposes of this review the investigations of feasible storage sites on the main stem of the Middle Snake River above the mouth of Salmon River, including diversion from the Salmon River, would be conducted by the Bureau of Reclamation, and the Clearwater, Salmon, and other areas by the Corps of Engineers. During this investigation, full interagency coordination has existed, and the reports of the division engineer, Corps of Engineers, and the regional director, Bureau of Reclamation, are transmitted herewith. These reports cover investigations of the Middle Snake River and

tributaries with particular reference to the most feasible storage sites which would have regional as well as local significance.

2. The findings of the Corps of Engineers and of the Bureau of Reclamation were incorporated in a joint report of the Chief of Engineers, Department of the Army and the Commissioner, Bureau of Reclamation, Department of Interior, dated May 21, 1954. Copies of that report, which are furnished herewith, were referred to governors of States affected and heads of other Federal agencies as required by law and the replies are attached. As indicated in letter dated April 22, 1955, the Department of the Interior is not prepared at this time to proceed further toward obtaining authorization for the construction of the Mountain Sheep and Pleasant Valley Dams recommended by the Bureau of Reclamation. Therefore, this report includes final recommendations of the Chief of Engineers only.

3. The most feasible sites in the area studied by the Corps of Engineers were found in the Clearwater Basin. After full consideration of the reports secured from the division and district engineers, the Board of Engineers for Rivers and Harbors, in report which is attached, recommends construction of reservoirs at Bruces Eddy on the North Fork Clearwater River and at Penny Cliffs on the Middle Fork Clearwater River for flood control, navigation, power, and other purposes generally in accordance with the plans of the district engineer as modified herein by the Board, and with such modifications as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $320,351,000 for construction and $1,326,000 annually for maintenance and operation, provided that prior to the installation of the log handling facilities at either site, local interests furnish assurances that they will operate and adequately maintain such facilities open to all on equal terms, and provided further that funds shall not be expended for the construction of experimental prototype fish-passing facilities at either dam until their need and practicability have been determined by the Chief of Engineers and until downstream obstructions to the passage of fish have been removed. After due consideration of these reports, the views of the Board as to these projects are concurred in.

4. The two proposed new dams in the Clearwater Basin are planned to have characteristics as shown in the following table. The relationship of these two proposed dams and the necessity for their construction are discussed in the attached joint report.

Dam and location	Head	Usable storage for flood control and power	Installed capacity	Cost	Benefit-cost ratio
	Feet	*Acre-feet*	*Killowatts*	*Dollars*	
Bruces Eddy, North Fork, Clearwater River	570	1,433,000	240,000	122,935,000	2.01
Penny Cliffs, Middle Fork, Clearwater River	590	2,300,000	292,000	197,416,000	1.72

5. After consideration of the views of the governors of affected States and other Federal agencies, as indicated in attached letters, I recommend the construction of the Bruces Eddy and Penny Cliffs projects, as outlined in the report of the Board of Engineers for Rivers and Harbors, at an estimated cost of $320,351,000 for construction and $1,326,000 annually for maintenance and operation, subject to special provisions outlined above.

6. It is further recommended that upon recommendation of the Idaho Department of Fish and Game, and within the limits of estimates given for fish-passing facilities, fish hatcheries may be constructed in connection with either or both of these projects, in order to replace actual loss of fish spawning grounds caused by construction of the dams, and that such hatcheries may be transferred to the State of Idaho without reimbursement, such hatcheries to be constructed without limitation as to the removal of downstream obstructions.

7. It is recommended that these projects be authorized for construction by the Corps of Engineers, since a firm Federal authorization is essential to comprehensive water resource planning of the main control plan of the Columbia Basin, whether or not a partnership arrangement should subsequently be authorized by Congress.

S. D. STURGIS, Jr.,
Major General, United States Army,
Chief of Engineers.

SECTION 3. RECOMMENDATIONS

240. The district engineer recommends that the Bruces Eddy project on the North Fork Clearwater River and the Penny Cliffs project on the Middle Fork Clearwater River, substantially as described herein, be adopted as a part of the main control plan set forth in House Document 531, 81st Congress, 2d session, and that plans for construction and operation of these projects provide for coordinated utilization of all potentials of these sites and their full integration into the comprehensive plan for multiple-purpose development of the Columbia River Basin.

F. S. TANDY,
Colonel, Corps of Engineers, District Engineer.

[First endorsement]

Subject: Review Report, Middle Snake River and tributaries (Lewiston to Pittsburg Landing), Idaho, Oregon, and Washington.
From: Office, Division Engineer, North Pacific Division, Corps of Engineers, 500 Pittock Block, Portland 5, Oreg., January 15, 1954.
To: Chief of Engineers, Department of the Army, Washington 25, D. C.

I concur in the views and recommendations of the district engineer.

D. G. SHINGLER,
Brigadier General, United States Army,
Division Engineer.

[Excerpts from H. Doc. No. 531, 81st Cong., 2d sess.]

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY,
Washington, D. C., February 14, 1950.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated June 28, 1949, from the Chief of Engineers, United States Army, together with accompanying papers and illustrations, on a review of reports on, and preliminary examinations and surveys of, the Columbia River and tributaries, Northwestern United States, made pursuant to several congressional authorizations listed in the report. Incorporated in this comprehensive report is a review of the long-range flood-control plans for the Columbia River Basin which was directed by the President of the United States in letters to the Secretary of the Army dated June 1 and September 16, 1948, after the disastrous flood of 1948.

In accordance with section 1 of Public Law 534, 78th Congress, Public Law 14, 79th Congress, and Public Law 732, 79th Congress, copies of the proposed report of the Chief of Engineers were furnished the Governors of the States of Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada, and the Secretary of the Interior. Copies of the proposed report also were furnished the Chairman, Federal Power Commission, the Secretary of Agriculture, the Chairman, International Joint Commission, the Chairman, Atomic Energy Commission, and the Chairman, Federal Interagency River Basin Committee, Department of Commerce, for such comments as they desired to make. The views of the States and the Federal agencies are set forth in the enclosed communications.

In accordance with section 4 of Executive Order No. 9384 dated October 4, 1943, the report was submitted to the Bureau of the Budget for information as to its relationship to the program of the President.

The comments of the Bureau of the Budget with appendixes are enclosed herewith. In summary, the report is approved for submission to the Congress, and the President recommends authorization by the Congress at an early date of the projects listed in appendix B, with limitations indicated therein. The list of approved projects omits certain recommended navigation and flood-control projects, listed in appendix A, and certain flood-protection works for which sufficient data are not at present available to provide justification.

The Bureau of the Budget has requested that the Department of the Army seek amendment of H. R. 5472 to eliminate the Columbia Basin projects now included in it which are not in accord with the program of the President, and to

include those projects which are not at present in the bill but are in accord with the President's program. Suggested amendments to accomplish this will be transmitted at an early date.

In view of its comprehensive scope and nationwide interest I recommend that this report with illustrations and appendixes be reproduced as a public document to facilitate utilization of the data and plans by all concerned in the long-range development of the Columbia River Basin.

Sincerely yours,

GORDON GRAY,
Secretary of the Army.

REPORT OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY

DEPARTMENT OF THE ARMY,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., June 28, 1949.

Subject: Columbia River and tributaries, northwestern United States.
To: The Secretary of the Army.

* * * * * * *

18. I therefore recommend—

(*a*) That the comprehensive plan outlined in the report of the division engineer, with modifications as outlined herein and in the report of the Board of Engineers for Rivers and Harbors, be approved as the basis for long-range development of the Columbia River Basin.

(*b*) That the following be authorized for early construction by the Corps of Engineers:

(1) The main control plan (table A of the accompanying report of the Board) less the Glacier View and Hells Canyon projects and the modifications to Grand Coulee and Hungry Horse Dams.

(2) The Willamette and other subbasin plans (tables B and C of the Board's report).

(3) An engineering laboratory (par. 45 (2) of the Board's report); all at an estimated cost to the United States of $1,570 million for construction and $11,650,000 annually for maintenance, generally in accordance with the plans outlined in the report of the division engineer and with such modifications as the Chief of Engineers may find advisable.

* * * * * * *

(*c*) That authority be provided to the Bureau of Reclamation for modification of Grand Coulee and Hungry Horse Dams and for construction of Hells Canyon Dam, and for their operation for flood control in conjunction with the main control plan projects as contemplated in the report of the division engineer.

* * * * * * *

LEWIS A. PICK,
Major General, Chief of Engineers.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

DEPARTMENT OF THE ARMY,
BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., February 21, 1949.

800.92 (Columbia River Basin).
Subject: Columbia River and tributaries, northwestern United States.
To: The Chief of Engineers, United States Army.

* * * * * * *

RECOMMENDATIONS OF THE DIVISION ENGINEER

35. The division engineer recommends—

(*a*) That the comprehensive plan be adopted as a general guide for further development of the water resources of the Columbia River Basin, and of the related programs of other agencies.

(*b*) That the main control plan be authorized for immediate construction and accomplishment at an estimated total Federal first cost of $1,733,822,000,

plus a subsequent Federal cost of $11,625,750 annually for operation and maintenance, to consist of—

(1) The following multiple-purpose reservoirs, dams and appurtenances:

(*a*) Libby project, Kootenai River, Mont.;
(*b*) Albeni Falls project, Pend Oreille River, Idaho;
(*c*) Priest Rapids project, Columbia River, Wash.;
(*d*) Hells Canyon project, Snake River, Oreg., and Idaho;
(*e*) John Day project, Columbia River, Oreg. and Wash.;
(*f*) The Dalles project, Columbia River, Oreg. and Wash.;
(*g*) Glacier View project, Flathead River, Mont., with provision for the substitution of a feasible alternate;

* * * * * * *

R. C. CRAWFORD,
Major General, Chairman.

HELLS CANYON PROJECT

181. *General.*—Hells Canyon site is considered one of the more advantageous sites for development of the reach of Snake River upstream from Lewiston in this subbasin. Investigation has shown the construction of a high dam at the site to be feasible. The project, previously recommended as a first step in the development of Snake River above Lewiston, would include power-generating facilities and a reservoir with sufficient capacity to effect a high degree of regulation on the flows of Snake River. The regulation would result in a substantial reduction of flood damage on Snake River below the dam and on Columbia River, would also improve conditions for open-river navigation on downstream reaches, and would increase power generation at downstream plants during periods of low flows. The reservoir would form a navigation channel which would serve an area now inaccessible. Power from the project could be added to the Northwest power system, thus aiding materially in relieving the current power shortage.

Mr. ZAHNISER. May I remark that those recommendations of the Army with regard to Bruces Eddy were dismaying to the fish and wildlife people in Idaho and Montana and to all of us. They followed a hearing held in Orofino at which our folks, the people that I represent from out there, came expecting to hear the whole comprehensive problem explained and then suddenly realized that they were faced with specific recommendations about two dams. Before they could organize their recommendations the hearing was over. Then the matter moved to Washington and the president of the Wilderness Society, Dr. Olaus J. Murie, along with Mr. Brandborg who just testified, attempted to talk to the Army engineers about that program and had difficulty even being heard.

The first think we knew the thing was recommended and ever since then, Senator Dworshak, we have been up against a burden of proof and a difficulty which is very frustrating, along the lines of our earlier discussion.

With the chairman's permission I should like to provide for this record a recent statement on this problem by Dr. Murie.

Senator DWORSHAK. May I say so far as I recall the report made on those Clearwater dams by the Army Engineers Corps, little if any reference was made to the fish and wildlife aspects of the project. Long before that, because of the criticism and the controversy involving those aspects of those proposed projects, I took the initiative more than a year ago in getting funds earmarked with which to make these surveys so that we would not have to rely upon misinformation and

prejudice and propaganda. I can agree with you that something should be done officially to make available all of this information.

Senator NEUBERGER. Thank you very much, Mr. Zahniser. We certainly appreciate your coming here today and bringing your views and those of the Wilderness Society, and Dr. Murie's statement will be inserted at this point in the record if you will provide it for us.

NEEDED: A NEW APPROACH TO WATER DEVELOPMENT

A statement by Dr. Olaus J. Murie, of Moose, Wyo., president of the Wilderness Society, on the proposed Bruces Eddy and Penny Cliffs Dams on the Clearwater River in Idaho, presented to Board of Engineers for Rivers and Harbors, in Washington, D. C., February 26, 1954.

The proposed construction of Bruces Eddy and Penny Cliffs Dams on the Clearwater River in Idaho would have effects on that part of the country that should have the most careful consideration before such plans are approved. Since the public hearing on these plans, at Orofino, Idaho, we have been able to assemble significant facts pertaining to this situation. I should like to discuss these facts and to discuss certain aspects of the water development program as they relate to the principle of public planning.

To begin with, the Penny Cliffs Dam would penetrate some 6 miles into the Selway-Bitterroot wilderness area on the national forest, an area which, by its designation as such, constitutes an assurance to the public that it is to be preserved in that category. We have here a public policy, a principle, closely linked with the principle of national parks, which our people are accustomed to think of as a permanent part of our social structure. Naturally the invasion of such an area by impounded waters is contrary to the very thing we are organized in the public interest to protect, and we wish to record our objection.

The elk herds in northern Idaho would be adversely affected by the plans for these two dams. The crucial fact is that big game species require winter range to survive. In the area here under consideration the locations that produce the browse species on which the wintering elk must subsist are largely in the canyons of the streams, the very places which would be flooded out by impoundments. A considerable portion of the elk herd of Idaho would be wiped out by these two dams. The extent of the damage could be ascertained more exactly if thorough study could be made.

So far as the fish resources are concerned, I am sure you must have the testimony of many others, calling attention to the proposed elimination of the steelhead trout and salmon by these engineering structures. Professional engineers in colloboration with fisheries biologists would of course admit this.

In view of this, does it not seem essential that we review our public planning procedures? Here we have an agency sincerely pursuing its work in one field of public planning. It finds that its plans run counter to the interests of other agencies which are authorized to plan for public welfare in other fields. And the American people as a whole are poorly informed in each case. On fairly short notice, a hearing is held and a decision is made, a decision that has an impact on certain phases of American living. Piecemeal, by successive decisions, large changes are made in our country without the public being aware of the long-range implications.

I do not believe we should cast the blame on the engineers. Rather, it is a way of doing public business that we have inherited from the time when the country was so thinly settled that there was room for independent planning without serious clashes of different interests. The time has come, however, when we must somehow achieve a more coordinated look at the future.

Shall we, or shall we not, value our salmon runs in the Columbia-Snake River waters? Is is our national purpose to keep our big game herds? Are we to have national parks and wilderness areas? Shall we make a decision on these fundamental questions? Who shall make the decisions? If by our present public planning, by piecemeal attrition, first in one place then in another, and another, we eventually eliminate the salmon, reduce our game herds to insignificant remnants, and in effect nullify the high principles of national parks and wilderness areas, are we not destroying something that belongs to the public, without the concurrence of the public? Under such a system, by piecemeal action, there has been no opportunity for public pronouncement of policy in

these matters. In fact, by such piecemeal action, involved largely in local commercial zeal, the general public is not made aware of the long-range results, and their significance.

Again, let me assure this review board that I am not placing responsibility for this system solely on the Army engineers. It is a system that we grew up with. Yet it is a system that the Army Corps of Engineers has an opportunity to help correct in the public interest. It is regrettable that the hearing at Orofino, Idaho, last November was conducted in such an undemocratic manner. I hope that blame for it will not be placed on the Army Corps as a whole. The other hearings with which I am familiar have been fair in every respect.

I should like to refer to a pleasant and hopeful experience. I attended a panel on water development, in New York. One of the speakers was a representative of the Army Corps of Engineers. After the meeting I introduced myself and sincerely complimented him on his address. He had stressed the importance of thorough coordination of all interests in public planning, from the very start of any such plan. Here was an instance when we were all speaking the same language. In my talk with this officer, I referred briefly to the hearing at Orofino, Idaho. He understood our concern and was sympathetic with our viewpoint on procedure.

I mention this to point out that a principle that seems to be demanded by present-day complexity of interests—namely, a more thoroughly integrated method of public planning—was urged in a public address by a representative of the Army engineers. If our public planning procedure could be motivated sincerely by such outlook many diverse groups could pool their facts and their objectives and achieve a plan for our country on the democratic basis.

I wish to emphasize that the plans for Penny Cliffs and Bruces Eddy Dams have been proposed for your consideration prior to adequate consideration of what the loss of fish, the drastic reduction of the elk herd, and the invasion of a wilderness area would do to the longtime interests of the American people, and before the public has had opportunity to appraise the values involved and the effects on the public interests in the large sense.

On behalf of the members of the Wilderness Society, and of many other organizations, east and west, I urge that this board of review discard the plans for these two dams and recommend a new approach to the solution of water problems of Idaho. Such action would be in the real interest of the people of Idaho, as well as of the Nation.

The members of the Wilderness Society have organized for the purpose of safeguarding the principle of wilderness areas and national parks as a national asset that we believe is vital to the welfare of our society in the years to come. Hence we are concerned with the integrity of designated wilderness and the wildlife associated with it. In this objective we have the wholehearted cooperation of many other organizations. Similarly, we of the Wilderness Society desire to cooperate with other conservation organizations in their objectives. The conservation movement of today is directed toward a goal that offers an environment beneficial to the public as a whole. It requires for its success the cooperation also of the governmental agencies, which likewise are responsible for the broad public interest, and we accordingly urge this review board to give earnest consideration to the recommendations here presented.

Senator NEUBERGER. The next witness this morning will be Mr. Marselis C. Parsons, who is Director of the Office of British Commonwealth and Northern European Affairs of the Department of State.

Mr. Parsons, we are glad to have you here.

STATEMENT OF MARSELIS C. PARSONS, JR., DIRECTOR, OFFICE OF BRITISH COMMONWEALTH AND NORTHERN EUROPEAN AFFAIRS, DEPARTMENT OF STATE

Mr. PARSONS. My name is Marselis Parsons, Jr., and I am Director of the Office of British Commonwealth and Northern European Affairs, Department of State.

I have here a brief statement, Mr. Chairman, which I should like very much to read, if that is agreeable with the committee.

Senator NEUBERGER. That is agreeable.

Mr. PARSONS. The committee has expressed special interest in the events relating to the Canadian proposal that there should be discussions between the two Governments concerning waters which flow across the international boundary, such as the Columbia, Yukon, and St. John Rivers.

The Canadian Government made this suggestion shortly before the March 26–27 meeting of the President and the Canadian Prime Minister at White Sulphur Springs. Prime Minister St. Laurent mentioned the subject briefly to the President at that time, and on April 9 reported on his conversation to the Canadian House of Commons, as follows:

I also suggested to the President that the time seemed to have come when problems regarding the use of waterpower on rivers crossing the international boundary might well be studied at a conference between representatives of the two Governments. Here I might perhaps extend this a little to answer a question of which notice was telephoned to my office by the Honorable Member for Kamloops, Mr. Fulton. There was no discussion of the problem, but merely the suggestion that it would probably be desirable at this time to have it studied by a joint conference representing the two Governments, to try to get at something which would make for the possibility of expeditious use of these waterpowers to the best possible advantage of the people who might derive advantage from their use. It was left at that, with the understanding that the subject would be further pursued in discussions between our Department of External Affairs and the Secretary of State of the United States.

The committee asked that it be provided with any official explanation or discussion of the Canadian proposal. Accordingly, there is submitted a transcript of the Prime Minister's report to the House of Commons and of the ensuing discussion as it appears on pages 2726–2729 of the Canadian House of Commons Debates for April 9, 1956.

If the committee so desires, there is certainly no objection to that being included in the record, Mr. Chairman.

Senator NEUBERGER. It will be included. You have attached this to your testimony?

Mr. PARSONS. Yes.

Senator NEUBERGER. It will be included.

(The transcript referred to follows:)

[From Canadian House of Commons Debates, 22d Parliament]

Extracts concerning the Canadian proposal for intergovernment discussions on waters which flow across the international boundary

EXTERNAL AFFAIRS

STATEMENT ON VISIT OF PRIME MINISTER WITH PRESIDENT OF UNITED STATES

On the orders of the day:

Hon. GEORGE A. DREW (leader of the opposition). Mr. Speaker, I wish to ask the Prime Minister if he will inform the honorable members of this House in regard to what was discussed, and, insofar as that is possible, what was achieved at the meetings in Virginia which he attended just before Easter.

Right Honorable L. S. ST. LAURENT (Prime Minister). Mr. Speaker, I anticipated that there might be such a question and I prepared a rather brief statement of what took place there which otherwise I would not have inflicted upon the House 10 or 12 days after the visit that has been so fully, although not always as accurately as fully, reported in the newspapers of both countries.

This visit took place at White Sulphur Springs on March 26 and 27 between the heads of Governments of the United States, Mexico, and Canada. The host at this meeting was the President of the United States who in his invitation and

subsequently emphasized that it would be of an informal character without agenda for the purpose of exchanging views on matters of mutual interest and of getting to know each other better.

In view of the character of the meeting, no decisions were reached and none was expected. It was, however, from my point of view, both helpful and agreeable to be in a position to discuss current international affairs with the Presidents of the United States and Mexico in this informal way. There was also an opportunity to bring up one or two subjects of specific Canadian-United States concern with President Eisenhower and Mr. Dulles.

* * * * * * *

I also suggested to the President that the time seemed to have come when problems regarding the use of water power on rivers crossing the international boundary might well be studied at a conference between representatives of the two Governments. Here I might perhaps extend this a little to answer a question of which notice was telephoned to my office by the honorable member for Kamloops (Mr. Fulton). There was no discussion of the problem, but merely the suggestion that it would probably be desirable at this time to have it studied by a joint conference representing the two Governments, to try to get at something which would make for the possibility of expeditious use of these water powers to the best possible advantage of the people who might derive advantage from their use. It was left at that, with the understanding that the subject would be further pursued in discussions between our Department of External Affairs and the Secretary of State of the United States.

Needless to say, the President expressed a very warm feeling for this country and gratification at the way in which relations between our two peoples were based on mutual respect and friendship and frank statement of diverging views, when there were diverging views. * * *

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Mr. FULTON. May I ask the Prime Minister whether his statement that it has been suggested that the problems of the control of the Columbia River should now be discussed directly between representatives of the Governments of the two countries means that the Prime Minister or the Government feel that the situation has got to the point where it is not likely to be solved under the agency of the International Joint Commission and that it should therefore be discussed at the higher level by direct negotiation between Governments?

Mr. ST. LAURENT (Quebec East). I would not like to say this was a higher level but there was a feeling that the chairmen of the two sections had publicly expressed views so diametrically opposed to each other that there was little probability of their being able to make the kind of progress we would hope would be made in arriving at a solution of these problems.

Mr. FULTON. If I may ask one further question, has a date, either definite or tentative, been set yet for the meetings?

Mr. ST. LAURENT (Quebec East). No. I would not even wish to convey the impression that the President had agreed that there would be meetings. He seemed interested in the suggestion and it was left that the matter would be further discussed between our Department of External Affairs and the Department of the Secretary of State.

Mr. FULTON. May I ask a further question with relation to the matter of the Columbia River development that was referred to earlier? Can the Prime Minister give the House assurance that the surveys and plans for the development of the Columbia River power in Canada will not be interfered with in any way because of the prospect of these negotiations, and that no such undertaking was implicit in the discussions?

Mr. ST. LAURENT (Quebec East). There was no undertaking implicit whatsoever. It was merely a suggestion that it might be desirable at this time to have the matter looked into, and the Columbia River was not referred to particularly. It was the rivers that cross the international boundary. The Columbia is one of them, the Yukon is another and the St. John in the east is another. There are several of these rivers. The matter was just referred to. The whole thing probably did not take more than 3 minutes, not as much time as it has taken in the House to answer the questions.

Mr. FULTON. There is no reason why surveys and studies in Canada should not proceed as before?

Mr. ST. LAURENT (Quebec East). My conversation with the President is not a reason why they should not proceed.

Mr. PARSONS. The Canadian suggestion received careful study within the United States Government and subsequently we informed the Canadian Government through diplomatic channels that we were agreeable to its proposal. I believe the committee has at hand the text of the press release which is being issued today by the two Governments announcing this agreement. The release will be issued at noon.

Senator NEUBERGER. Can you read that to us this morning?

Mr. PARSONS. Yes.

Senator NEUBERGER. I wish you would do so at the end of your statement.

Mr. PARSONS. Yes.

The problems connected with waters crossing the international boundary are immensely broad and complex. They encompass an examination of the basic principles which were incorporated in, or omitted from, the Boundary Waters Treaty of 1909—and involve technical engineering and economic questions which have developed as geographic areas have become so much more heavily populated and heavily industrialized than was the case in 1909.

It is apparent that the policy under which the Department of State can conduct such discussions must be formulated to accord with the interests of the several affected agencies of the executive branch of the Government. Therefore, prior to further action on the Canadian suggestion, the Department of State consulted with the agencies of the Federal Government having an interest in or responsibility for our water resources. Thereafter the Department of State suggested to the Bureau of the Budget that it provide for the establishment of an advisory committee on Canadian boundary water problems. It was decided that this could be most appropriately achieved by establishing it as a subcommittee of the existent Interagency Committee on Water Resources to be composed of the following: Gov. Len Jordan, Chairman of the United States Section of the International Joint Commission; Maj. Gen. John S. Bragdon, special assistant to the President for public works planning; and one representative each from the Department of State, Army, Interior, and Justice, and the Federal Power Commission.

The Chairman of the Interagency Committee on Water Resources is proceeding to set up this Advisory Committee, and it is my understanding that he has already invited the various agencies to designate their representatives.

With the appointment of the Advisory Committee, the Department of State will be in a position to examine more thoroughly the many complex questions connected with rivers flowing across the border. It has been recognized informally by both the United States and Canadian Governments that it may take a while to formulate our respective national studies and also that during this period it will be helpful to exchange views on the subjects in which each side is likely to be most interested. This will make it possible to coordinate our work more effectively on the various problems and will prepare the way for discussions later in the year.

Senator NEUBERGER. Would you please read the press release which is being issued today? I would appreciate it.

Mr. PARSONS. The press release is being issued today at noon and will be issued simultaneously in Ottawa at 2:30 this afternoon.

The Canadian and United States Governments have decided to examine together the subject of waters which flow across the international boundary between the two countries. The last time both Governments examined this matter thoroughly together was before the conclusion of the Boundary Waters Treaty of 1909. During the 46 years which have elapsed since its ratification the International Joint Commission which was established by the treaty has worked with outstanding success in solving water problems within the framework of this treaty. It has recently appeared, however, that the development of the resources of such basins as the St. John, the Columbia, and the Yukon, requires, among other things, the solution of various complicated legal, economic, and engineering questions.

In agreeing to examine the matter of waters which cross the boundary, the two Governments realize that there may be no easy or quick answer to the problems which are arising today in such areas and that the studies may reveal that the boundary waters treaty of 1909 is sufficiently broad to meet present problems. The two Governments believe, however, that a full and confidential exchange of views may contribute to the resolution of these problems, and it is in this spirit that the discussions have been agreed to. At the same time the two Governments desire that the International Joint Commission shall press forward its studies under the Columbia River Basin reference of 1944 and the other similar references which it has under consideration.

Senator NEUBERGER. Thank you very much, Mr. Parsons.

Senator Laird, do you have any questions of Mr. Parsons?

Senator LAIRD. No; no questions.

Senator NEUBERGER. Senator Dworshak.

Senator DWORSHAK. No questions.

Senator NEUBERGER. I would like to ask you several questions. I would like the record to show at this point that the first recommendations made in the report on upper Columbia River development which I submitted to the chairman of this committee, to Senator Murray, last December 1955 was as follows:

That responsibility within the United States Government for these important negotiations be raised from the level of a purely advisory committee like the United States Section of the International Joint Commission and be explicitly assumed by the policymaking executive departments themselves.

Of course I am pleased that that recommendation has been accepted so completely by the executive department. Would that all my recommendations to the executive department have such a happy fate.

I would like to ask you several questions, if I may, Mr. Parsons.

Do you have any knowledge at all of the identity of the appointees to this Board which will meet with Canada?

Mr. PARSONS. We do not have that, I am sorry, Mr. Chairman.

Senator NEUBERGER. You don't know, for example, whether a Foreign Service officer or officers will be named to represent the Department of State?

Mr. PARSONS. As far as the Department of State is concerned it is our hope that a Deputy Assistant Secretary would represent the Department.

Senator NEUBERGER. At that level, I see. I think it is fine that it will be at as high a level as that, because it seemed to me from the time I visited Canada and talked to Canadians, after my talk with people on our side of the line, that something like that was necessary to bring about a reasonable solution of the joint use of the resources of the Columbia River watershed.

I am extremely pleased that this development has taken place. I think it is rather late, but I am very glad that it is going to occur.

Do you have anything further that you wish to add at all?

Mr. PARSONS. Thank you. Nothing.

Senator NEUBERGER. Thank you very much, Mr. Parsons. I am very pleased that you were here, and thank you for your testimony and for the welcome news that you bring.

Our next witness will be the Honorable Len Jordan, Chairman of the United States Section of the International Joint Commission.

STATEMENT OF HON. LEN JORDAN, CHAIRMAN, UNITED STATES SECTION, INTERNATIONAL JOINT COMMISSION

Senator NEUBERGER. Do you have a prepared statement today?

Governor JORDAN. No. I was informed that no statement was expected, so I have none prepared.

Senator NEUBERGER. Do you have any questions of Governor Jordan that you care to ask?

Senator LAIRD. None.

Senator NEUBERGER. Senator Dworshak, do you have any questions?

Senator DWORSHAK. I don't think Governor Jordan has testified since the opening day of this hearing a month or two ago.

Senator NEUBERGER. That is correct. I just thought in view of this recent development you might have some questions.

Senator DWORSHAK. I don't think so.

Senator NEUBERGER. I would like to ask some questions, if I may, Governor Jordan.

Is this move being made today, the announcement of which has been brought to us by Mr. Parsons, with the complete concurrence of the International Joint Commission?

Governor JORDAN. Yes, indeed. Of course it has.

Senator NEUBERGER. Do you think it is a wise move?

Governor JORDAN. Yes, I think it is.

Senator NEUBERGER. Why do you think it is?

Governor JORDAN. Because the Canadians requested it.

Senator NEUBERGER. Why do you think the Canadians requested it?

Governor JORDAN. I don't think I should paraphrase their own language. You have it in the record, Senator.

Senator NEUBERGER. After all, this is an unusual situation which has developed. I felt it was necessary. The reason I am trying to get your reasons is the following:

It was the major recommendation that I made last December in my report to Senator Murray. I think you will remember that. At that time when I made my report to Senator Murray you were sharply critical of it, which was of course your right and privilege. Now you come here today and believe it is a wise move that that recommendation is being carried out. I just wondered what the reasons were that prompted your change of mind on that question.

Governor JORDAN. We always try to cooperate with the Canadians. They have requested it now. I think the machinery is available to do the job in the setup of the International Joint Commission. Inasmuch as the Canadians have requested it, we strive at all times to meet them halfway, more than halfway, in fact.

If you could call that a reason for my change in attitude, I offer that as a reason, Senator.

Senator NEUBERGER. Unless it is in Mr. Parson's statement, I do not have the full text of the Prime Minister's statement. May I ask Mr. Parsons, is this the full text of the Prime Minister's statement in the House of Commons or a paraphrase?

Mr. PARSONS. That is the text of it, Mr. Chairman.

Senator NEUBERGER. In other words, then, Governor, the substance of the remarks of the Prime Minister in the House of Commons constitutes the reasons for your approval of the step being taken today by the two governments?

Governor JORDAN. I wouldn't say that, Mr. Chairman. The fact that the President consented that these discussions go forward is ample reason why I am prepared to carry them out.

Senator NEUBERGER. But this is a most extrordinary situation. This is the first time this has occurred in the history of our negotiations, as I understand it. I am just trying to find out, because I think it is important for the record of this hearing and probably for the future conduct of these negotiations, what reasons you think constitute the justification for this step, because it is obvious that you did not think so in December of 1955.

Governor JORDAN. I am sure I don't know what kind of an answer you want. The fact that the President agreed with the Prime Minister that discussions of this nature were in order is reason enough why I approve of it.

Senator NEUBERGER. I am very pleased that you do approve of it because I think, as I have said for a long time, it is a necessary step.

In going over your earlier testimony before our subcommittee, Governor, I gather that as of the present time there is comparatively little activity within the International Joint Commission as regards actual negotiations relating to mutual use of the Columbia River. Is that substantially correct?

Governor JORDAN. That is correct, Mr. Chairman, for reasons which I gave in my statement. The Canadians have informed us that they are proceeding with studies unilaterally for the development of their resources, including possible diversion. A little over a year ago now the chairman of the Canadian section informed a committee of the Parliament that those studies might require 2 years to complete and another year and a half to evaluate. You are aware—I think it is in the record—that with respect to the application which is before the International Joint Commission for the United States Government to build Libby Dam, the Canadian Government has said that they are not prepared either to approve or disapprove until they complete these diversion studies. So for that reason, because of the Canadian unwillingness to discuss these matters, they are more or less at a standstill.

Senator NEUBERGER. I have noted in going over the records that General McNaughton said on March 9, 1955, in his testimony before the Committee on External Affairs—

> On the other hand, I reported on May 7, 1954, that the Canadian Commissioners had not been able to persuade our colleagues in the IJC in the Libby case to agree and discuss any recompense whatever of the resources of Canada in the way of head and flow which were to be used in that project if it were undertaken.

I realize this is a reference to a time prior to your own coming on the IJC as the American chairman. Later in the same days hearings General McNaughton said:

> Turning again to Libby, may I mention that we now have a new application, May 1954, from the United States Secretary of State, Mr. Dulles. This does not seem to represent any more favorable approach to the problem of an equitable division of benefits.

I also am aware that in reply to the Canadian statement of July 7, 1954, the United States Department of State informed the IJC that the United States was prepared

> to consider equitable recompense to Canada through the sale of power or otherwise for the value which Canadian natural resources would have to the production of power, taking into account the extent to which the project will result in compensatory benefit to Canada.

In putting these quotations in the record, the thing I am trying to get at is whether this offer was given to and received by the Canadian section of the IJC.

Governor JORDAN. Will you repeat your question again, please?

Senator NEUBERGER. Yes. In other words, the Department of State, as I understand it, informed the IJC that the United States was ready to consider some fair compensation to Canada through the sale of power or otherwise for such value as would be put on the Canadian resources, Canadian storage in the Libby project. Was this offer made to the Canadian Section?

Governor JORDAN. That became a part of the official records of the International Joint Commission.

Senator NEUBERGER. And it was made to them?

Governor JORDAN. Yes, indeed. It was before my time, but it was made.

Senator NEUBERGER. I assumed it was, and that leads up to the question which I think is at the heart of this. What explanation, then, would you put on General McNaughton's statement that "It does not seem to represent any more favorable approach to the problem"?

Governor JORDAN. I don't put any explanation on General McNaughton's statement.

Senator NEUBERGER. Let me ask you this: You have been negotiating with them. The Libby project is a vital project, one of the finest storage projects in terms of benefit-to-cost ratio, as you know, in the Columbia Basin. Do you have any reason at all to explain why, following this State Department offer or explanation or presentation, that General McNaughton still said, "It does not seem to represent any more favorable approach to the problem"?

Governor JORDAN. I still don't have any explanation for the General's statement.

Senator NEUBERGER. Do you think that he is completely hostile to the Libby project, judging from his comments on that State Department presentation?

Governor JORDAN. No; I am not at all sure that he is.

Senator NEUBERGER. Governor Jordan, let me ask you another question about another phase of this development. It is my understanding that you have often spoken of the need to develop storage in the United States.

Governor JORDAN. Yes.

Senator NEUBERGER. In your various talks, public talks, on both sides of the international line, such as to the Pacific Northwest Trade Association and elsewhere in other comments you have talked about the possibility that the use of steam power in the United States might preclude a very high value being placed on Canadian storage. Is that a fair analysis?

Governor JORDAN. Yes; that was actually a part of the report of the Interagency Committee which made a study on Canadian storage, a summary of which has been made a part of this record. I was only repeating data which were assembled by that Interagency Committee.

Senator NEUBERGER. In other words, it is the summary report of the Interagency Committee which has been in the background of some of your public statements about the possibility that steam power, as I say, might obviate a very high premium being placed on Canadian storage? The interagency study is the basis for that.

Governor JORDAN. Yes; quite substantially so, Mr. Chairman.

Senator NEUBERGER. If I am not mistaken, for example, just to cite one project, doesn't the interagency study presume the construction of Penny Cliffs Dam?

Governor JORDAN. It is included as a possibility.

Senator NEUBERGER. It is included as a possibility.

Governor JORDAN. Yes. It was recommended by the Corps of Engineers for construction.

Senator NEUBERGER. So it is included, as I understand it. I have read the interagency study. It is included in the interagency study, if I am not mistaken.

Governor JORDAN. Mr. Chairman, they started with a base set of projects, and they added one at a time and collectively a number of different projects to that base system. Penny Cliffs, Bruces Eddy, and a number of others were individual projects that were reported on in that report.

Senator NEUBERGER. What I am trying to get at is this: I may be entirely wrong, but it is my opinion that certainly a very vital factor in this whole situation which has resulted in the press release of today in Washington and Ottawa have been the very direct statements made by yourself that the use of steam power to supplement the dams in the United States might well diminish the value of Canadian storage to us south of the line.

Governor JORDAN. That is quite possible, Mr. Chairman. I think General Itschner testified before this committee that the practical limit of waterpower development in the Columbia Basin was approximately 12½ million kilowatts. At our present rate of growth we are going to arrive at that point sometime before the year 1970, at which time the only recourse will be, of course, to add steam. We will go then to a system of integrated steam and hydro. When I talk about the introduction of steam into the system I am only giving voice to the findings of that joint committee.

Senator NEUBERGER. You mean of the Interagency Committee?

Governor JORDAN. That is right.

Senator NEUBERGER. That is right. You are giving voice to the Interagency Committee. I realize that. The thing I am trying to get at is, you have said here—and I am going to read subsequently from the interagency study—for example, just one project, Penny

Cliffs, is assumed as a part of the interagency study, as a part of the system.

Governor JORDAN. That or its alternate.

Senator NEUBERGER. Which is its alternate?

Governor JORDAN. Any equivalent storage on a tributary having the characteristics such as Penny Cliffs.

Senator NEUBERGER. The thing I think the record must show is this. Penny Cliffs is part of the interagency study in the so-called C-level base system which you have cited in your discussion. Isn't Penny Cliffs in there?

Governor JORDAN. Of course C level is not a hard-and-fast system of projects to the exclusion of anything else. Even in the 308 report they talk C–1, C–2, C–3, C–4, each one of them representing a different set of projects which would achieve approximately the same results.

Senator NEUBERGER. I would like to read this particular paragraph and put it right in the record here, so we will see what we are talking about. This is the summary report on special interagency study on United States and Canadian storage projects April 15, 1955 [reading]:

> To determine the impact of these Canadian and American projects on the integrated United States system at a higher stage of development, the so-called "C level" base system has been used. It assumes the existence of Clark Fork Basin storage equivalent to Glacier View and Paradise projects, Hungry Horse, Flathead Lake, Kootenay Lake, Albeni Falls, Grand Coulee, Penny Cliffs, Bruces Eddy, Middle Snake, Chief Joseph, Priest Rapids, Lower Snake, McNary, John Day, The Dalles, and Bonneville Dam, with a total nameplate capacity of about 13 million kilowatts and about 21 million acre-feet of storage operated for power production. Table 1 compares the prime-power capability of the C-level system with that of the initial system.

Penny Cliffs is listed here. Yet you were here today when the senior Senator from Idaho said—I think I quote him accurately—that Penny Cliffs certainly was not contemplated at all at that time. Am I correct in that, Senator Dworshak?

Senator DWORSHAK. Mr. Chairman, may I correct the record if I left a misunderstanding. I meant so far as my own planning was concerned to utilize the resources of the Clearwater River system that I was concentrating my efforts on Bruces Eddy as being the more desirable of the two projects. I was not in any way referring to any statistics or recommendations on the official record.

Senator NEUBERGER. Thank you very much, Senator Dworshak.

You have heard what was said today by the representatives of several wildlife groups about Bruces Eddy and Penny Cliffs. You certainly know that Glacier View is in extreme controversy.

Governor JORDAN. Yes; indeed.

Senator NEUBERGER. As I understand, there has been a filing by the Montana Power Co. on the Paradise Reach in the Buffalo Rapids area; is that correct?

Governor JORDAN. I wasn't aware of that.

Senator NEUBERGER. I would like to ask the staff about that.

Mr. MAPES. A preliminary permit has been granted for the study of Buffalo Rapids projects Nos. 2 and 4, either one of which would interfere with the Paradise storage project.

Senator NEUBERGER. The reason I have asked about this, Governor, is this: In talking to various people in Canada, both in and out of their Government, I received the impression that your speeches about our firming up with steam power rather than putting a high premium

on Canadian storage certainly was something of a factor in the existing situation in which the diversion is being studied and has been authorized in Parliament and so on.

Governor JORDAN. Mr. Chairman, may I correct the record right at this point. I was Governor of Idaho until January 6, 1955. The diversion studies with respect to putting the Kootenay River across Canal Flats into the Columbia were announced in March of 1954.

Senator NEUBERGER. That is correct.

Governor JORDAN. The diversion studies with respect to transferring the waters of the Columbia River to the Fraser above Revelstoke were announced in a press release by Minister Lesage in December of 1954. I was still Governor of Idaho until 1955, Mr. Chairman.

Senator NEUBERGER. It is my understanding that diversion has been talked of variously for 8 or 10 years. It is also my understanding that the first time it was authorized by Parliament was, I think, in April or May 1955; is that right or wrong?

Governor JORDAN. Let me go back again. One statement the Canadian Government made on the Libby project, which is in the record—it was, I believe, in July of 1954—in which they said they were not ready either to approve or deny the application of Libby until they had completed studies with respect to diversion—that comes as nearly being an official statement as anything I know. That was a statement which I can find in my file, but it is in the record already, Mr. Chairman.

Senator NEUBERGER. I am just asking for information. When was the first time that Parliament approved funds for the study of the diversion?

Governor JORDAN. I am sure I don't know. I assume it was a regular order of business, having announced that they were going to do it. It was only a natural procedure, it would seem to me.

Senator NEUBERGER. I gathered there was extended controversy and discussion in the external affairs committee of the House of Commons in April or May of 1955 before it was authorized. I think there were extensive hearings in which General McNaughton was a repeated witness; is that correct or not?

Governor JORDAN. Yes; I think that is correct.

Senator NEUBERGER. Again what I am trying to get at is this: Your comments on the more favorable use of steam power are based—and certainly you are right—on the interagency study. The thing I am trying to point out is that the interagency study assumes the development of sites in the Columbia watershed that are in extreme controversy.

Governor JORDAN. That is true. I don't know any dams that aren't in controversy, Mr. Chairman, for one reason or another. As a matter of fact, there is a review going forward right now on House Document 531 being conducted by the corps and the supporting agencies or other agencies of the Government collaborating, in which they are bringing up to date the old 308 report and House Document 531. In that study I think General Itschner informed this committee they are exploring various other storage sites within the United States. This is a moving, living thing. It is never stable.

For purpose of developing a particular set of figures they may select a group of sites as representing C-level, but as valid objections are raised to any particular project in that system, replacements are

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sought, and they are continually working to that end, as you well know, because I am sure you are familiar with the study which is going forward out there now.

Senator NEUBERGER. But the thing I don't understand is how many alternative storage sites are there? When asked about Penny Cliffs you said perhaps that or its alternative. What would be an alternative to Penny Cliffs?

Governor JORDAN. You are asking the wrong man, Senator. If you would get General Itschner in here, who is thoroughly conversant with the study which is going on, you certainly would get the information.

Senator NEUBERGER. General Itschner hasn't told us there is an alternative to Penny Cliffs. You have.

Governor JORDAN. There are possibly alternates for any one of these. I am not saying that there are or are not.

Senator NEUBERGER. For example, you said on page 27 to the interagency committee meeting:

> One conclusion to be drawn from the report is that we must explore our own storage projects to see how much and how soon we can bring them into the integrated system. I am not moving over with the high Hells Canyon people. There are better storage sites.

Governor JORDAN. Yes.

Senator NEUBERGER. It is you who is saying there are alternative and better storage sites. Let me ask what are the better storage sites than Hells Canyon.

Governor JORDAN. Mr. Chairman, I am glad to inject this into the record at this time because I think it is pertinent, especially after listening to the testimony this morning. We are yet concerned with flood control in your own area, in the Portland area, in the lower Columbia Basin. We still do not have an adequate system of flood control to protect that area.

Senator NEUBERGER. Right.

Governor JORDAN. Readings at Oxbow gage in the vicinity of Hells Canyon indicate that the Snake River contributes normally to the flow of the Columbia River at The Dalles about 10 percent at its flow in an average year. In the flood year 1948, when over a million cubic feet per second went past The Dalles, less than 5½ percent of it came past the Oxbow gage. In other words, the normal contribution of 10 percent was reduced by nearly one-half, in a flood year, indicating the effect of the tremendous amount of storage upstream from the Oxbow gage which will be, when completed, 8½ million acre-feet or thereabouts, which is about two-thirds of the normal annual runoff of the Snake River at Oxbow.

Then in contrast we have the Clearwater River which under normal conditions contributes about 8 percent of the flow of the Columbia River at The Dalles. It contributed during the flood year 1948 17½ percent of the flood flow at The Dalles.

It is very good to talk about conservation and preservation of wildlife, and no one is more in sympathy with that objective than I, but, Mr. Chairman, I submit that lives and property should have some consideration in this picture as well. If we are going to control floods we have to go where floods originate. Floods do not originate characteristically in the portions of the Snake River above Oxbow as they do

in some of the flooding tributaries such as the Clearwater and the Salmon.

Senator NEUBERGER. When you said last May 27, "There are better storage sites," I take it that you meant the sites on the Clearwater?

Governor JORDAN. Much better from the flood-control standpoint. I recognize, as you do, because that strikes at my home and my backyard—I recognize the threat to conservation, to wildlife. Finally, I believe these matters can be resolved so that we can have sound water-resource development and still maintain a sound conservation policy.

Senator DWORSHAK. I assume that either the chairman or the Governor would refer to the Nez Perce site when talking about alternative sites. That is the most ideal site of all; is it not?

Governor JORDAN. I think it is generally conceded to be, Senator.

Senator DWORSHAK. It will control the floodwaters from the Snake River watershed and from the Salmon River watershed; is that right?

Governor JORDAN. That is right.

Senator NEUBERGER. Does the International Joint Commission favor development of the Nez Perce site?

Governor JORDAN. We favor any proper storage which would add to the control of our flood problems.

Senator NEUBERGER. You do realize the very great controversy involving the Nez Perce site, being below the mouth of the Salmon where about 60 percent of the whole spring Chinook salmon——

Governor JORDAN. You interrupted me before I finished, Senator. I was going to say that all of us who work on river problems have given up that great Nez Perce site until such time as the fisheries matters are resolved. I think we recognize it as being a fine engineering possibility and one which would control one of the worst flooders of the entire Columbia Basin, the Salmon River. But with our present ability to handle salmon, both migrating salmon upstream and fingerlings downstream, we have even quit talking about the Nez Perce Dam.

Senator NEUBERGER. Again I return to this basic thing. You have indicated today, Governor, that you are very much aware of the specific controversy involving many of these sites.

Governor JORDAN. That is right.

Senator NEUBERGER. Yet you have made statements to the Canadians about the value of their storage based on an interagency study which presumes development of these controversial sites, and you yourself have such specific and accurate knowledge of the sources of the controversy at each of those sites.

Governor JORDAN. That is true. You have specifically pointed out here Penny Cliffs, where there is a storage of a little over 2 million acre-feet. I am hopeful and I am sure that other sites can be found within the Columbia Basin where we can capture that much storage without the controversy which surrounds Penny Cliffs.

Senator NEUBERGER. There is also a controversy at Glacier View.

Governor JORDON. Oh, yes.

Senator NEUBERGER. Similar, if I am not mistaken, to which involved Echo Park.

Governor JORDAN. I think so. As a matter of fact—well, I would like permission to insert in the record, Mr. Chairman, because I am talking here without even notes, I would like permission to insert a list of the possible storage sites that are being explored by the Corps

of Engineers and the other interested agencies of the Federal Government. I would like permission to insert them at this time because I think it would clear up a lot of controversy concerning the Penny Cliffs site. I would just like the record to show such a list of potential storage projects which are being explored.

Senator NEUBERGER. Without objection that will be included at this point.

(The information referred to follows:)

Potential storage projects in United States portion of Columbia River Basin

Name of project and stream		*Usable storage (acre-feet)*
Snake River Basin:		
Bruces Eddy, North Fork, Clearwater River		1,433,000
Penny Cliffs, Middle Fork, Clearwater River		2,300,000
Narrows, Grand Ronde River	1,000,000	
Troy, Grand Ronde River	500,000	500,000
Rondowa, Grand Ronde River	660,000	
Pleasant Valley, Snake River		500,000
Brownlee, Snake River		1,000,000
Horseshoe Bend, Payette River	1,000,000	1,000,000
Garden Valley, Payette River	1,250,000	
Owyhee, Owyhee River	715,000	700,000
Duncan Ferry, Owyhee River	700,000	
Marsing, Snake River	975,000	950,000
Thousand Springs, Snake River	950,000	
Reregulating dam (below Palisades), Burns Creek		105,000
Alpine, South Fork, Snake River		1,000,000
Clark Fork Basin:		
Mile 35, Flathead River		400,000
Improve outlet, Flathead Lake		500,000
Swan Lake, Swan River		600,000
Spruce Park, Middle Fork, Flathead River		400,000
Smoky Range, North Fork, Flathead River		1,500,000
Ninemile, Blackfoot River		600,000
Atkins, Rock Creek		120,000
Thompson River		250,000
Kootenai River Basin:		
Libby, mile 217, Kootenai River		5,010,000
Long Meadows, Yaak River		450,000
Meadow Creek, Moyie River		300,000
Spokane River Basin:		
Enaville, Coeur d'Alene	600,000	310,000
Leland Glen Coeur d'Alene	310,000	
Mile 59–65, St. Joe River		200,000
Kettle River Basin: Curlew		150,000
Wenatchee River Basin: Wenatchee and Chiwawa Rivers		150,000
Increase in Grand Coulee usable storage		1,030,000

Senator DWORSHAK. Governor, you indicated that while Nez Perce would be a logical site to control the waters of the three Idaho River watersheds, there is objection because we have not yet solved the fisheries aspects of it. Would you say that it is possible to control devastating flood waters such as we experienced in 1948 arising in the upper watershed, by building John Day or dams like McNary or the Dalles or Bonneville in the lower basin to protect the people in the Portland area from these floodwaters?

I know that sounds like a simple question, but I have had people point out that if we want to control these floodwaters maybe we ought to build alternative damsites, so let's go around Portland and build one in the backdoor of Portland. Would that control the floodwaters on the Salmon and the Clearwater?

Governor JORDAN. No, you have to go where these floods originate really to give them adequate control. As a matter of fact, the dams that you mentioned on the main stem of the Columbia have all been reduced to strictly run of river status.

Senator DWORSHAK. I know that. It is impossible to impound floodwaters in the lower basin.

Governor JORDAN. That is right.

Senator DWORSHAK. Certainly.

Is it not also true that the reason the Snake River does not constitute a flood hazard today is because we have built numerous dams in the upper reaches of the Snake like the Palisades Dam which will be completed this fall and several other dams which have been proposed to impound this water and keep it and divert it in the upper watershed so it will not become a hazard down in the Middle Snake River section?

Governor JORDAN. You are right, sir. As a matter of fact, if the whole rest of the Columbia River had the same storage protection as the Snake River, we might expect that the Columbia system would have possibly 85 million acre-feet of storage because the Snake River which normally contributes 10 percent to the flow of the Columbia, as you know, will have when completed approximately 8½ million acre-feet. So if 10 percent has 8½ million acre-feet, if we had a comparable development in the whole rest of the system, Senator, we might expect that the whole Columbia system might have 85 million acre-feet.

Senator DWORSHAK. Is it not also true, Governor, that in the Upper Snake River we divert water for reclamation? I think we have approximately 2½ million acres of reclaimed land using the Snake River water for irrigation, and the Snake is the only river in Idaho where any appreciable amount of reclamation is used. There is no reclamation on the Salmon, there is no reclamation on the Clearwater, and very little on the Kootenai, if any. Is that correct?

Governor JORDAN. That is correct.

Senator NEUBERGER. In other words, then, I take it that so far as the Snake River is concerned, regardless of the depth of the snow pack in the mountains or anything else, you don't regard the Snake River as any very grave potential hazard, so far as floods are concerned.

Governor JORDAN. Not as compared with these other streams we have been discussing.

Senator DWORSHAK. And not when we complete all the contemplated reservoirs in the upper watershed of the Snake. Isn't it true that several dams are proposed to be built in the upper reaches comparable to Palisades?

Governor JORDAN. Yes.

Senator DWORSHAK. What is the storage at Palisades?

Governor JORDAN. It is 1.2 million acre-feet.

Senator NEUBERGER. Let me ask you about this again, though. Don't you believe that it might have been more advisable to have the alternative storage sites to these controversial locations decided upon and recommended by the engineers if indeed there are alternative sites before certain representations were made to the Canadians about steam power obviating the need for their storage?

Governor JORDAN. Oh, no. I think it is quite proper at any time that I should give voice to the studies that are taking place on this side. As a matter of fact, we exchange this information freely. The Canadians have been provided with copies—not of the summary report which you have but the whole report, Mr. Chairman. There has been a fine feeling of cooperative exchange between the countries in that respect. That I pointed out some of the facts and conclusions which that study reached I think should not in any way be an indictment of me, certainly.

Senator NEUBERGER. The point I am making is that you based your conclusions, as you yourself have said, and quite properly, on the special interagency study.

Governor JORDAN. That was the conclusion of the interagency study.

Senator NEUBERGER. That is right.

Governor JORDAN. I reiterate that.

Senator NEUBERGER. You made these representations to them because you were the avenue by which they get their information and conclusions.

Governor JORDAN. Mr. Chairman, they had already been furnished far more than the summary. I repeat, they had been furnished a complete report.

Senator NEUBERGER. Did any of that indicate to them the various controversies which you yourself have indicated surrounds some of these various sites in the schedule?

Governor JORDAN. No; I don't think the interagency report went into the controversies which surround the several sites, no.

Senator NEUBERGER. Of course, the interagency study, as I read earlier, used the word "assumes" existence, and then went on and listed all these projects, some of which are in quite extreme controversy.

Governor JORDAN. That is right. However, it was only for purposes of computing system load characteristics, and so on, that they used a particular set of projects.

Senator NEUBERGER. Because of your interest in flood control—and I certainly share it—what do you think about the value of Mica Creek and Murphy Creek as flood-control projects?

Governor JORDAN. They have a value. I refer to the record, the interagency report, which gives some flood-control values to those Canadian storage projects. They are farther removed. They are less effective than storage which is closer to the flooded area or the danger area.

Senator NEUBERGER. You don't think they would have too much value?

Governor JORDAN. I refer to the record. I think the interagency committee had a sheet even in their summary report where they gave some value to Canadian storage projects for flood control.

Senator NEUBERGER. I think you were present, if I am not mistaken, when General Itschner testified, and I asked him what project he thought should be built first if there were no international boundary at all, just assuming it was all one country. If I am not mistaken, he did list the Libby first and Mica Creek second.

Mr. MAPES. I believe those are the two projects which were mentioned. I think the order was Mica first.

Senator NEUBERGER. Would you check that? I would like to ask Governor Jordan's opinion of that because I think that is important to have.

Senator DWORSHAK. Governor, the Kootenai River is a real flood threat at the present time; is it not?

Governor JORDAN. Yes; I understand one of the dikes went out yesterday, flooding one of the districts.

Senator DWORSHAK. The river is at a higher flood stage than it has ever been in the past.

Governor JORDAN. Close to 36 feet, I believe.

Senator DWORSHAK. Libby Dam would correct that situation to a large extent.

Governor JORDAN. Yes, sir.

Senator NEUBERGER. I am trying to recall. I think General Itschner mentioned those two projects. You were present at that time.

Governor JORDAN. Yes; I was present.

Senator NEUBERGER. How do you feel about that comment of his, that if there were no international boundary those are the two projects he felt should be built first.

Governor JORDAN. If you are asking me what projects I would build if there were no international boundary—you are talking now about Libby, Arrow Lakes, and Mica Creek.

Senator NEUBERGER. Any projects that are contemplated within the basin. That is the way my question to him read.

Governor JORDAN. Of course, I think we have to have some flood control down on the Clearwater because any stream that contributes 17½ percent to the floodwaters in your home area, Mr. Chairman, is certainly a threat to life and property. We have to reconcile our differences, whatever they may be, with the wildlife people as nearly as we can, and certainly I would press for early and rapid reconciliation of those differences so we could get some flood control on that potentially damaging tributary.

With respect to the others, I think I would probably start them all at once. Now we are assuming no international boundary. I would start them all at once, Arrow Lakes, Mica Creek, and Libby, for this reason:

Arrow Lakes can be built in about 2 years and be in the system in that length of time. Assuming that we could resolve our differences with the wildlife people, it would require 5 or 6 years to bring in Bruces Eddy. It would require 6 or 7 years to bring in Libby and as much as 10 years to bring in Mica Creek. So if there were no international boundary and my advice was sought and the program hinged on the decision I made, I would say start them all at once.

Mr. MAPES. Libby was General Itschner's first choice and Mica Creek was second.

Senator NEUBERGER. Let the record show that in General Itschner's reply to me he listed Libby first and Mica Creek second as, in his opinion, the most desirable projects, if there were no international considerations.

Governor JORDAN. I think they are all important to the optimum development of the Columbia River, and because of the fact that there are different time periods for construction and, therefore, different times of completion, I think without any doubt if there were

no international boundary it would be a good move, if other matters could be reconciled to start them all at once.

Senator NEUBERGER. I would like to ask you several questions if I may about your own personal views on the Columbia River development. You have given us some of them.

If all the dams on the main stem of the Columbia were privately owned and privately operated, do you think it would be wise that the man first and primarily responsible for our negotiations with Canada, that might lead either to an increase or diminution in the feasibility and value of those projects, be an all-out opponent of private development on the main stem of the Columbia?

Governor JORDAN. Is that a question, Senator?

Senator NEUBERGER. Yes; it is.

Governor JORDAN. I missed it; I am sorry.

Senator NEUBERGER. If all the dams on the Columbia, such as Grand Coulee, McNary, and Bonneville, were privately owned and operated, if they were private dams, do you think it would be wise to have as the man responsible for negotiations with Canada, that could possibly lead to either expanding or imperiling the power capacity of those dams, an announced political opponent of private ownership of such dams?

Governor JORDAN. This is a hypothetical question. I would have to give it some study, Senator.

Senator NEUBERGER. I am thinking back to the statement you made in Portland in 1951, I think it was, when you said that the time had come "to stop Federal Government expansion in the region until all avenues of development by private enterprise have been fully explored."

That is a statement by you which I would interpret as being quite adverse to Federal power expansion in the Columbia Basin.

Governor JORDAN. Yes, I made substantially that statement at that time. You will recall, Senator, that the threat of a Columbia Valley Authority was still imminent and many other speakers were protesting the threat of an unregulated monopoly of Federal power.

Senator NEUBERGER. The thing that I wondered is that your official function is to serve as negotiator for our Government with Canada, presumably to develop the greatest feasible output from the Federal Columbia River power system. Yet you have criticized and attacked that system very vigorously.

Governor JORDAN. I would criticize and attack a complete and unregulated monopoly, Senator, whether it be 100-percent Federal, 100-percent local public, or even 100-percent private in any system. I think the combination of all of those several types of development with the people at the local level determining which type they prefer is probably the best development for a river basin.

I am not alone in that opinion, I am sure. One of the best speeches on this subject was made by Senator Wayne Morse on the floor of the Senate on August 18, 1950. I recommend it to you. Out in the Northwest we live with quite a variety with respect to the pattern of ownership. The Northwest power pool consists of investor-owned utilities, municipal, PUD districts, Federal power, and yet they all get along very splendidly. They realize that by integrating their transmission lines and pooling their resources, they actually achieve

a bonus in the overall operation of the system which makes it appear that the whole is even greater than the sum of all its parts. They get along splendidly. I think that is a fine example of how a river basin can be developed properly.

Senator DWORSHAK. Governor, do you know what percentage of the total power of the Northwest power pool is generated by private or non-Federal agencies and what percentage is generated by the Federal Government?

Governor JORDAN. Senator, I don't know exactly and it should be an exact figure. I would like to get that information for you, if I may.

Senator NEUBERGER. Governor Jordan will obtain that information for the record of the committee.

(The information to be furnished follows:)

Northwest power pool as of Dec. 31, 1955

	Nameplate rating, kilowatts
1. Federal power: (*a*) Columbia River power system (BPA)	3,999,000
2. Non-Federal public power:	
(*a*) Seattle, city of	602,260
(*b*) Tacoma, city of	297,000
Subtotal	899,260
3. Private utilities:	
(*a*) Idaho Power Co	349,350
(*b*) Montana Power Co	481,940
(*c*) Pacific Power & Light Co	322,790
(*d*) Portland General Electric Co	209,820
(*e*) Puget Sound Power & Light Co	300,500
(*f*) Utah Power & Light Co	551,130
(*g*) Washington Water Power Co	354,650
Subtotal	2,570,180
Grand total	7,468,440

SUMMARY

	Kilowatts	Percentage
Federal power	3,999,000	53.6
Non-Federal public power	899,260	12.0
Private utilities	2,570,180	34.4
Total	7,468,440	100.0

Senator NEUBERGER. Any other questions at this time, Senator Dworshak.

Senator DWORSHAK. No.

Senator NEUBERGER. The only point I make is that you did say in this speech the time had come to stop Federal Government expansion in the region until all avenues of development through private enterprise have been fully explored.

Isn't it a fact, Governor, that depending on your negotiations with Canada for upper Columbia River storage, the only projects that would be affected, with the exception of one comparatively small dam at Rock Island, would be Federal projects?

Governor JORDAN. Oh, no; not at all, sir. Several public-utility districts have preliminary permits. As a matter of fact, one has a license to construct. Priest Rapids is one of them.

Senator NEUBERGER. I am talking about existing projects.

Governor JORDAN. You are correct with respect to existing projects, but Canadian storage cannot possibly be added to the existing system. By the time Canadian storage could be available in quantity, our system will have doubled in size.

Senator NEUBERGER. After all, if we had any litigation with the Canadians, our claim to waters would be principally involving existing projects, not necessarily entirely, but our claim mainly would be based on existing projects.

Governor JORDAN. Yes.

Senator NEUBERGER. So if I am not mistaken all the existing projects on the Columbia that either would be expanded by Canadian storage or imperiled by Canadian division are, with the exception of that small dam at Rock Island, Federal projects?

Governor JORDAN. That is correct.

Senator NEUBERGER. So they are quite dependent on the success or failure of these negotiations.

I must admit for the record in all candor that the statement I have quoted which you made in Portland in 1951 was when you were Governor of Idaho and you certainly didn't occupy this position. I certainly believe you had no contemplation of occupying it. But I am also referring to the speech that you made before the Oregon Farm Bureau Federation in Salem, in our State, in November of 1955, at which time you were the Chairman of the International Joint Commission, if I am not mistaken.

Governor JORDAN. That is right.

Senator NEUBERGER. You were very critical of the "Federal or nothing" political candidates in the Northwest. You said that their actions constituted a fraud, and so on. Of course as a private citizen you have a right to say anything you want of it. That is the reason this is a great country. But I would like to ask, do you really think it is wise and advisable for someone in our position negotiating with the Canadians for use of the Columbia River, which certainly is the equivalent to that of a high ranking foreign service officer in many respects, to engage in such extreme partisan comments on the Federal power system which you yourself are negotiating to expand if the negotiations are successful? Do you think that is advisable?

Governor JORDAN. It is a matter of opinion. My comments were directed against those who would have Federal development or no development. I hate to feel that in any position I hold I was circumscribed in stating what I believe, Senator.

Senator NEUBERGER. Oh, no. I think you have every right as an American citizen to express any political view of any kind you want, and I would defend that right, but I just wonder if these very extreme comments on that Federal power system are advisable in view of your role as the principal negotiator for the United States with our neighbors in Canada for use jointly of the Columbia River system, and on which these Federal projects are so dependent?

Governor JORDAN. Mr. Chairman, I am a native of the Northwest. That is my home. I have worked consistently for a sound water re-

source development. You are taking one statement I made out of context. Let me go on as my memory brings these facts back to me. I recall what went with that. I said that the Northwest had been getting about 40 percent of the appropriations which the Congress had made for water resources development, and I pointed out that according to the best estimates we have of our load growth in the Northwest if we were to keep ahead of the demand it would require something on the order of $300 million a year of expenditure on hydroelectric projects for the next 10 years, a total of $3 billion, but that sum would represent twice as much as we had been able to get from the Congress in prior years. I submit that it is unrealistic to assume that any representative of the Northwest can tell the people of the Northwest that they can bring home a sum of money twice as great as the appropriations have been in the past and to mislead the people into thinking that that can be done.

Senator, that is my opinion.

Senator NEUBERGER. I will say this so we are fair to you: If you have no objection, I am going to submit your speech before the Oregon Farm Bureau on November 15, 1955, your entire speech, for inclusion in the record so there will be no piecemeal presentation of it.

Governor JORDAN. Very good.

Senator NEUBERGER. But I would like to read several consecutive paragraphs, if I may, and I will leave nothing out. This appears near the opening of the speech. Naturally, I don't read the entire thing because of the limited time. You said:

> For 20 years, first in the Tennessee Valley and later in the Pacific Northwest, we had drifted—and at times almost galloped—toward a Federal monopoly in water-resource development—toward a philosophy that the Federal Government has an obligation to supply electric power to these regions (just why in these two basins and not elsewhere is not clear).
>
> In support of this philosophy, there evolved a school of thought whose disciples believe that the Federal Government can meet the situation bigger, better, quicker, and cheaper than anyone else. Just why these "Federal or nothing" zealots limited their sphere to water-resource development is also not clear.
>
> It would seem that since the Federal Government owns about two-thirds of the area of the 11 Western States, the possibility of federally owned sawmills to process timber, of federally owned mines to develop mineral resources, of federally owned fish canneries to harvest salmon run, of federally owned farms and livestock ranches to utilize the crop and grazing lands—all of these should have been attractive to the "Federal or nothing" schemers.
>
> But it may be that these last-mentioned programs to develop the resources that "belong to all the people" would have come along later in their timetable of conquest. Certainly it is easy to see that the control of the electric power of an area is a very alluring and exciting goal in power politics.

Supposing all of these dams on the Columbia River were private dams and the man in charge of the negotiations had made a speech in this context but with the same criticism of private dams that you have voiced of Federal dams, would you think that that was a discreet and prudent type of public pronouncement and in keeping with that man's responsibility?

Governor JORDAN. I wouldn't crucify him for it, Senator, if he believed it.

Senator NEUBERGER. I am not crucifying you. I also wonder if you think that it is compatible with negotiating with the Canadians in the best possible context of international negotiations concerning these Federal projects which are downstream on the Columbia, to make

public pronouncements of this sort which are so critical of what has been undertaken by the Federal Government on the Columbia River.

Governor JORDAN. If your question is, would I think that my mind would be prejudiced against a fair consideration of trying to work out a mutually acceptable plan for optiumum development with the Canadians, my answer is "No."

Senator NEUBERGER. In this same Salem speech you emphasized the fact that in the parts of the United States where there is a so-called Federal monopoly, these two regions are constantly confronted with crises and power shortages. Did you not mention that?

Governor JORDAN. That is right.

Senator NEUBERGER. Don't you think if you are to be fair to this system for which you are negotiating, you should have mentioned that in both the Northwest and in Tennessee, which you mentioned critically, there is a far higher use of electricity per capita and per resident than in any other part of the United States?

Governor JORDAN. Yes; there are a number of commendable things that might have been said. That is one of them; yes.

Senator NEUBERGER. For example, just for the record, the power use in the Northwest is about 6,000 kilowatt-hours per residential customer as compared to the national average of about 2,500 kilowatt-hours. Certainly couldn't that have been a factor in the shortage, in other words, that homes are using over twice as much power each year in the Northwest as nationally?

Governor JORDAN. Of course it could.

(Governor Jordan's speech of November 15, 1955, follows:)

REMARKS OF LEN JORDAN, CHAIRMAN, UNITED STATES SECTION, INTERNATIONAL JOINT COMMISSION, BEFORE THE OREGON FARM BUREAU FEDERATION, SALEM, OREG., NOVEMBER 15, 1955

I am greatly pleased that you asked me here to speak to the annual meeting of the Oregon Farm Bureau Federation. Back through the years I have come to have a very special regard for your fine organization and the high principles for which you stand. Because all of my life I have lived close to the soil, I share with you an unswerving dedication to sound farming practices and the rewarding satisfaction that comes from taking good care of our land and water resources. My interest therefore is not purely speculative, but derives from many years of practicing conservation and working daily with the problems of resource development.

Then, too, I am always pleased to have an excuse to come back to Oregon. My family home is Enterprise, Oreg. Enterprise is the Oregon gateway to the Hells Canyon country. I attended public schools there and finally graduated from the University of Oregon. It was there I met my wife, who was also an Oregonian. I shall always be grateful to this State for all that was done to provide me with an education. I remember, too, how the $25 per month which Oregon provided for her veterans made it possible for me to stay in school.

Here in Oregon, it is good to renew many old and highly valued friendships, not the least of which is with your able and distinguished governor. Paul Patterson and I are friends of long standing—not only were we classmates at the University of Oregon, but for part of a year when we were doing graduate work, we lived together. So I take personal pride in his fine record of accomplishment and, knowing his qualifications as I do, I predict for him, should he seek it, a great future in the service of his State and Nation.

I am reminded that Salem is the home of another great Oregonian who is making good in the major leagues—the Secretary of the Interior, Douglas McKay, whom I came to know and respect when he served you well as governor. Back in Washington, he is discharging one of the toughest jobs in the Cabinet with complete fairness and with dignity and skill. In the 10 months I have been in Washington, I have found it both pleasant and productive to consult with him frequently on matters having to do with water resources development.

As Chairman of the United States Section of the International Joint Commission, it is my duty along with my two colleagues to safeguard the interests of the United States in our dealings with Canada over boundary waters and rivers which cross the boundary. Our instructions under the treaty of 1909 with respect to boundary waters are very well defined with the result that we are able to proceed amicably and equitably with such splendid joint projects as the Niagara River remedial works, the St. Lawrence seaway project, and the gigantic power projects in the International Rapids section of the St. Lawrence River at Barnhart Island.

Unfortunately, the principles having to do with rivers which cross the boundary are not so explicit as those principles for rivers forming the boundary. Thus, with respect to the Columbia, we find ourselves occupied with the Canadian Section in discussions of diversions, of fish versus dams, and of downstream benefits from headwater storage. I shall not at this time detail either our differences or our areas of agreement.

I should like to repeat, however, that the United States Section is eager and willing to discuss development plans for the Columbia River that will be of benefit to both countries.

On April 12, 1954, when, as Governor of Idaho and chairman of the Northwest Governors' Power Policy Committee, I made a speech before the Pacific Northwest Trade Association at Portland, Oreg., in which I said:

"I am pleased that in our Northwest Governors Power Policy Committee we have enjoyed the active participation of Canada. Not only the Province of British Columbia but Canadian utilities as well have served with us and we profit by their service. Our interests are so closely integrated that it would be folly to plan separately. Much of the ultimate success of maximum river development will depend on how well we can integrate our planning.

"Adequate annual storage as close to headwaters as possible is absolutely necessary to efficient river system power production. Records indicate that about half of the annual runoff of the Columbia takes place in the 3 months of May, June, and July. Recorded flows at The Dalles show a variation of from a low of 40,000 cubic feet per second to a record high of nearly a million cubic feet per second. Several of the best storage sites are on the Canadian side. The Mica Creek site alone could store 10 million acre-feet of usable annual storage. In addition to at-site production, downstream benefits from such storage are substantial. We urgently need a cost and benefit allocation survey for upstream storage as an equitable basis for agreement with our Canadian neighbors. No other single accomplishment would lend greater stimulus to river-basin progress than this."

These quotes indicate how I felt 18 months ago, before I even knew there was to be a vacancy on the International Joint Commission. I have not changed my mind.

I tell you frankly that the reason I went to Washington, D. C., to work on the Eisenhower team in the field of water-resource development was because I believe in the rightness of the administration policy.

But before we discuss the policy of the present administration, let us have a look at the water-resource picture of 1953 when the new administration moved in.

For 20 years, first in the Tennessee Valley and later in the Pacific Northwest, we had drifted—and at times almost galloped—toward a Federal monopoly in water-resource development—toward a philosophy that the Federal Government has an obligation to supply the electric power for these regions (just why in these two basins and not elsewhere is not clear).

In support of this philosophy there evolved a school of thought whose disciples believe that the Federal Government can meet the situation bigger, better, quicker, and cheaper than anyone else. Just why these Federal-or-nothing zealots limited their sphere of conquest to water-resource development is also not clear.

It would seem that since the Federal Government owns about two-thirds of the area of the 11 Western States, the possibility of federally owned sawmills to process the timber, of federally owned mines to develop the mineral resources, of federally owned fish canneries to harvest the salmon run, of federally owned farms and livestock ranches to utilize the crop and grazing lands—all of these should have been attractive to the Federal-or-nothing schemers.

But it may be that these last-mentioned programs to develop the resources that "belong to all of the people" would have come along later in their time-

table of conquest. Certainly it is easy to see that the control of the electric power of an area is a very alluring and exciting goal in power politics.

There is a special kind of challenge in the political power that is inherent in the control of the electrical power of a region.

Electricity has come to be a necessity in your home, on your farm, in the business houses and industrial plants of the Nation. It is almost as essential as the water we drink and the air we breathe. Under conditions of scarcity, Federal officials who control the production and distribution of electricity in a region of Federal monopoly can dictate the location of industry, the rates which users must pay and the amount of energy available. They are not subject to regulation by the Federal Power Commission or by State regulatory commissions as are non-Federal agencies. They have within their hands the economic life or death of the customers or of a community under this monopoly.

This might not be true if there were always an ample supply of energy available, but history has demonstrated that in these areas where a Federal monopoly exists, the region lives from one crisis to another, from one power shortage to another, depending on the whims of an always reluctant Congress to provide money for additional power. Such areas live in a perennial power shortage.

We have seen here in our own Northwest various electricity customers pleading for additional power from a system that produced not enough to go around. This is not a healthy situation. It is not good for America when political officials, whether they belong to my party or the other fellow's party, are in a position to grant or deny the right of any American citizen to start or expand a business.

Monopoly is not good—whether it be private or public monopoly, it results in arbitrary management, in indifference to the wishes of the people to be served, and it removes all incentive toward economy and efficiency, the two factors which are so essential to a free economy.

But let us assume for a moment (and certainly for no longer than is necessary to emphasize a point)—let us assume that the Federal monopoly advocates have entirely overcome the resistance locally—that not one single voice in the entire Northwest speaks out in opposition to their Federal-or-nothing philosophy—the question then is: Just what chance have they dollarwise to keep their promises for 100 percent Federal development?

First, we must consider the demand—what kind of money will be needed to keep ahead of the load growth? A joint committee representing all the non-Federal agencies in the power business in the Northwest appeared before a committee of Congress last spring with some figures. They have agreed, and they have officially and publicly declared that it will require $3 billion in the next 10 years to provide an adequate power supply for this region.

Future needs will require an average expenditure of $300 million a year.

Do you know what has been the average appropriation for the Northwest for the last 10 years including the free-spending appropriations to complete war emergency commitments? Past appropriations have averaged $150 million a year.

Do you realize that during the last 10 years, the Northwest, with about 3 percent of the population, has had approximately 40 percent of all the money of the whole United States that has been appropriated by Congress for hydroelectric development?

Now I ask you, is it realistic to assume that the other 97 percent of the people in the other 44 States of the Nation are going to continue to put 40 percent of the total appropriations for hydro power into one limited area?

And I ask you further, do you believe that in this day when the emphasis in Washington is on a balanced budget and a reduction of the Federal debt—when the trend of this administration is definitely away from Federal monopoly—do you think for 1 minute that the Federal-or-nothing candidates here in the Northwest who ask you to support their philosophy can bring home twice as much money for hydro power as you have had in the past?

I'm sure you don't believe any such thing and I don't think they do either. Here is another case of political sophistry that we could pass off for the fraud that it is if it were not for the very serious effect that these tactics of delay and obstruction have on the orderly development of our water resources. I shall have more to say about this later.

Other Senators have taken a much more realistic attitude when faced by the inability or unwillingness of the Congress to appropriate Federal money for projects already authorized for Federal construction.

Witness the case of the Coosa River project. Last year Senators Sparkman and Hill, together with 8 of the 9 Alabama Congressmen, introduced and secured the

passage of a bill to deauthorize Federal construction of hydroelectric dams on the Coosa River in Alabama and permit that construction to proceed by an investor-owned utility, the Alabama Power Co. Because, they said, the project had been authorized for many years and, loyal Democrats that they were, they were never able to get money for its actual construction from either the Roosevelt or Truman administrations.

Witness also a similar case in Oklahoma. Last year, Senators Kerr and Monroney secured the passage of a bill to deauthorize construction of hydroelectric dams on the Grand River in Oklahoma and to authorize the Grand River Dam Authority, a State agency, to proceed with that construction. They also had waited 10 years for Federal appropriations.

These Senators and Congressmen from Alabama and Oklahoma are realists. They recognize the practical political fact that it had not been possible to secure from the Congress controlled by their own party and under Presidents of their own party, the money that was required for necessary hydroelectric development in their own States.

I hope you will pardon me for relating a few personal experiences to point up the transition that has taken place in the field of water-resource development in the past 4 years or from one administration to another.

When I became Governor of Idaho in January 1951, the Federal monopoly advocates were still in the saddle, but riding with some caution. They had suffered some setbacks at the polls because the voters of the Northwest were alerted to the danger of a valley authority for the Columbia patterned after the Tennessee Valley Authority and had in most instances defeated the candidates who espoused the valley-authority concept. The three Northwest Governors McKay, Langlie, and Robins had in 1948 openly and publicly declared against any form of a Columbia Valley Authority.

The most pressing and interesting prospect for resource development from where I sat in the spring of 1951 was the renewal of a proposal by the Bureau of Reclamation to construct a high dam at Hells Canyon. Personally this had great interest for me.

It was in 1932, at the depth of the depression, that my wife and I, with our 3 children—Steve, aged 7 months; Joe, 3½; and Patsy, 6—moved to an Idaho sheep ranch on the Snake River just below Hells Canyon. There were no roads, no schools, no churches, few neighbors. The roof-pitched hillsides—"steep as a cow's face," we used to say—were covered with bunchgrass that was abundant and lush and nutritious.

Despite the inconveniences and occasional hardships, this epoch in our lives was full of rich and rewarding experiences. Nine years later, we emerged with excellent health, a wholesome respect for plain living and hard work, and an abiding determination to conserve and protect the bounteous resources of nature.

Many times I have dreamed of the day when the tremendous power potential of the river would be harnessed for man's use. And from personal experience I know some of the vagaries of the river.

Moreover, as Governor, I was interested in the development of my State. I was aware of the tremendous short-term prosperity my State would enjoy with the spending of that kind of outside money.

Few people realize to what extent the Snake is a "working" river. It is the lifeblood of Idaho. Nearly 3 million acres in southern and eastern Idaho are irrigated from its waters, and possibly another million acres are available to be reclaimed when economic conditions warrant. The headwaters of the Snake are used and reused for irrigation. In most years all of the water in the river near Twin Falls is diverted at Milner Dam for irrigation.

Hells Canyon is downstream from all present or future irrigation in Idaho. Not one single acre could be irrigated from Hells Canyon storage. The high dam advocates have always painted a rosy picture of the availability of power revenues to subsidize future irrigation projects. But more of that later.

Of all the tributaries of the mighty Columbia, Snake River is by far the best regulated. Contributing at Hells Canyon no more than 10 percent of the average annual flow of the Columbia, this one-tenth part which is Snake River now has in use and under construction about 9 million acre-feet of irrigation and flood-control storage—practically as much storage as exists in the other nine-tenths share—or all of the rest of the entire Columbia system. To be more specific, if the entire Columbia system had storage in the same ratio as Snake River above Hells Canyon, the system would have about 90 million acre-feet, which is more than 3 times as much storage as the Corps of Engineers consider necessary for their main control plan.

As a consequence, the Snake is not a "flooder." In the flood season of 1948 it contributed less than one-half the flood flow of Salmon River and less than one-third the flood flow of Clearwater River.

President Truman had endorsed a high dam for Hells Canyon. Naturally, it had the blessing of the Bureau of the Budget and of Secretary of the Interior Chapman and of Commissioner of Reclamation Strauss. Having failed once before in securing an authorization, they apparently decided this time to enlist local support by working out the draft of the authorization bill from the Boise office of the Bureau of Reclamation.

Among other things, the sponsors of the Federal high dam promised to meet two essential requirements, viz:

1. Protection of present and future water rights for irrigation.

2. Use of power revenues to subsidize reclamation of approximately 300,000 acres of new land near Mountain Home, Idaho.

These were laudable objectives. Many conferences were held in my office between officials of the Bureau of Reclamation who were instructed to draft a bill and various State officials and other interested Idaho people. Some of us even made a trip to Washington, D. C., to consult with Secretary Chapman, Commissioner Strauss, and others.

Our intense research and scrutiny began to point up some very disquieting facts. Congressmen Budge, of Idaho, himself an able water lawyer, was among the first to suspect that Idaho's water rights were being placed in jeopardy. This was a shocking discovery and was supported by all of our legal advisers.

Our counsel contended that the right of the Federal Government to build hydro powerplants derived from the Constitution, either the navigation or general-welfare clauses; that for this reason, words written into an authorization bill intended to guarantee protection to private irrigation rights, present and future, could not possibly supersede the paramount constitutional right of the Federal Government to control the waters of the Snake River; that some future administration might conclude that water flowing through the turbines at high Hells Canyon to sustain the production of electric energy might better serve the public interest than if this same water were consumed upstream by present or future irrigators. To date, no one has convinced me otherwise.

On the other hand, a like development by non-Federal interests would definitely be subject to and controlled by State law under which both our Constitution and numerous statutes declare that the use of water for irrigation has a higher preference than the use of water for power.

Meanwhile, Governor Langlie had assigned competent engineering personnel to assist in scrutinizing the economic feasibility of the high dam. After much research and many consultations, our engineers working together reached the conclusion that the Department of Interior proposal to build a high dam at Hells Canyon was not the best plan for the development of that stretch of the Snake River. (The rightness of their conclusion is borne out by the recent unanimous decision of the Federal Power Commission which, after hearing evidence for nearly 2 years, approved the applications of Idaho Power Co. to construct 3 dams at a cost less than half that of the single high dam.)

Our investigations further disclosed that the Bureau of Reclamation figures on cost of supplying water to land to be reclaimed in the Mountain Home project would exceed $1,200 per acre, about $200 of which could be repaid by the landowner, while similar land could be bought with water and with improvements for about $400 per acre. I believe in reclamation; I like to see the desert made productive with water, but someone has to pay for these projects. Is it fair, is it justifiable, to spend taxpayers' money for a dam that would cost two and one-half times as much as its comparable alternate just in order to take advantage of reclamation law which permits power revenues to be used, under certain conditions, to subsidize irrigation? The subsidy in this instance would be about $1,000 per acre. Someone in the future would be charged enough more for his electricity to pay not only the excessive cost of the high dam but also the excessive cost of the irrigation subsidy.

I am sure there are better ways to get water on the Mountain Home project.

Having reached thees conclusions, I was completely disillusioned with the promises of the high dammers to safeguard our water rights and to provide subsidies from power to reclaim new land. That is why I felt it was my duty to go to Washington late in the spring of 1952 and oppose, before a committee of the Congress, a bill to authorize Federal construction of a high dam at Hells Canyon. I think my appearance there on that mission was probably the reversal

of a pattern. Over the years it had become the accepted custom for a governor to go periodically to Washington, pleading for handouts. I know that many of the Congressmen on the committee were shocked to hear me say that Idaho did not want some $400 million of Federal money spent for a high dam on our border; that I feared such a project would jeopardize our water rights and that I believed we could best develop our own river under our own State laws subject, of course, to such Federal regulations as required of the licensee by the Federal Power Commission as a condition of the granting of a license.

Late in July of 1952, I was invited to Denver, as were many others, to confer with Candidate Eisenhower and staff on matters of importance to my State in the coming campaign. Among other matters, a water resources policy was discussed because it was of such vital concern to my Idaho constituents.

At this Denver meeting we set up a conference of Candidate Eisenhower and his staff with the western governors at Boise, Idaho, to further discuss problems of the West. Here again at Boise, late in August, among other matters we discussed the importance of a sound water resources policy.

Naturally we were pleased when, early in the campaign, General Eisenhower expressed his confidence in the American people and his belief that our future in water resource development lies with the people and not solely with a Washington bureaucracy. He said:

"We insist that this must be done through partnership, through first of all getting the wisdom, the power, and the facilities that are available in the locality and bringing in the Federal Government, not as a boss, not as your dictator, but as a friendly partner ready to help, and to get its long nose out of your business as quickly as that can be accomplished.

"We hold that these projects are far better planned, developed, and operated with the full cooperation and wisdom of the local authorities than they are by putting them exclusively under the direction of some long-haired bureaucrat sitting behind a desk in faraway Washington, D. C."

What a gratifying relief to have such a fresh, new look into the problem. The President has faith in America. He has faith in the American people, in their ability to solve their own problems, to stand on their own feet, and to carry on the traditions of their forefathers.

The Eisenhower administration believes in a dynamic and expanding economy for the United States. It believes that by unleashing the ability, the determination, and the ambition of the American people, the economy will continue to expand, the output of goods and services will continue to rise, living conditions will constantly improve, wages will keep pace with the economy, and that the United States, guided by this buoyant confidence, is approaching greater horizons of progress than many of us could foresee.

But, you say, what are the tangible results of this program?

We are at peace, and uneasy though it may be, it has raised the hopes of people throughout the world to the highest point in many years.

We are at an all-time level of prosperity. Our gross national product stands today at an annual rate of $390 billion. Our personal disposable income is $272 billion. We have never approached these figures before.

We have more people at work, more jobs, more employment than ever before, and these people are receiving more take-home pay with more purchasing power than they ever had before.

I agree that the one discordant note in the entire picture is the fact that farmers are not sharing proportionately in this prosperity. It is very difficult to overcome the very damaging consequences of an inherited farm program that was never right or workable from the outset. There is no easy answer to the farm problem. You may be sure of one thing—this administration will not return to the high rigid price-support program which contributed substantially to our present condition. Your fine organization has cooperated fully in trying to find a workable solution to the vexing problem. I am sure that you will continue to advise and work with the best talent which this administration can devote to the task of improving the farmers' share of the national prosperity.

But, returning to the matter of water resources—

President Eisenhower, in his state of the Union message to the first session of the 83d Congress, said:

"* * * The best natural resources program will not result from exclusive dependence on Federal bureaucracy. It will involve a partnership of the States and local communities, private citizens, and the Federal Government, all working together. This combined effort will advance the development of the great river valleys of our Nation and the power that they can generate."

I am amazed that anyone would criticize the President's type of approach to this great public program. The partnership idea means people working together. There is nothing new or startling in this approach. It is simply the reactivation of a time-tested American custom. It means that the Federal Government will continue to sponsor those projects which, because of international or other extraordinary conditions, cannot be undertaken locally. It means that local interests, public or private, will be encouragd by the Federal Government to go ahead with necessary power projects on their own. It means also that in some instances, the Federal Government will share the cost of a project with local interests.

I call your attention now to a splendid example of international partnership achieved by this administration. I refer to the great St. Lawrence seaway and power project. This billion dollar development comes under the purview of the International Joint Commission. Last month I had the pleasure, with my colleagues from both the United States and Canadian sections, of a 2-day inspection of the works. When completed this project will provide a 27-foot navigation channel from the Great Lakes to the Atlantic, and a powerplant which in total output will be second only to Grand Coulee. The local sponsor in this instance, working with the Federal Government on the United States share of this development, is the Power Authority of the State of New York.

You may be surprised to know that during the period 1906–53, some 27 partnership projects were constructed in 13 States. In these cases the Federal Government was operating on a partnership basis with States, municipalities, and with private corporations.

You may be surprised to know also that of these 27 projects, 12 were built under Republican administrations and 15 were built under Democratic administrations.

Not until this administration advocated a return to sound principles did the word "partnership" assume an evil connotation, and then only in the minds of a few frustrated people who seek to play power policies with power development.

At least three partnership proposals are being discussed that affect Oregon directly.

A meritorious bill sponsored by Congressman Harris Ellsworth presently before Congress would authorize the partnership construction of the Cougar and Green Peter-White Bridge projects here in Oregon.

Both are flood-control projects and units of the partially completed Willamette Basin project. Their construction would prevent flood damage estimated at $2,500,000 annually.

The Corps of Engineers would build Cougar and Green Peter-White Bridge Dams. The power facilities, including reregulating dams, may be constructed under FPC licenses by the local interests, or by the Corps of Engineers as agents, and paid for by the local interests. The power facilities would be owned by the non-Federal agencies and operated at their expense.

The dams remain the property of the Federal Government, and except for the power facilities, are to be operated and maintained by the Corps of Engineers. The licensees pay to the United States the proportionate shares of the cost of construction operation, and maintenance of the dams that are allocated to power, as determined by the Corps of Engineers and the FPC.

The bill authorizes the Corps of Engineers to enter into agreements with the licensees for operation of the dams and reservoirs to secure the maximum multiple benefits from the projects.

This legislation permits construction of 2 critically needed flood-control projects at a saving of approximately $40 million.

The bill does not specify local participants but the Eugene Water and Electric Board, an arm of the city of Eugene, Oreg., had indicated a desire to participate in the Cougar project. The Pacific Power & Light Co., of Portland, Oreg., has stated its willingness to participate in the Green Peter project. The dams are located within the respective areas served by these utilities.

A unique application of the partnership principle is embodied in the bill introduced in Congress last spring by Representative Sam Coon to authorize the building of John Day Dam on the Columbia River between the Dalles and McNary. Under the provisions of this bill, John Day Dam would be designed, built, and operated by the Corps of Engineers and ownership would at all times remain in the Federal Government. Investor-owned utilities are willing to sponsor this project but provision is made for the participation of other local interests, public or private, which meet certain specified requirements.

Under this bill the Federal Government would assume costs of navigation, flood control, and other so-called nonreimbursable benefits. These costs are estimated to be about 10 percent of the total cost of the $310 million project.

Local interests would supply the major share amounting to $273 million which would be in the nature of a prepaid contract for the power output of the project for a period of 50 years.

Encouraged by the administration's policy of cooperation, proposals for dam construction have come from many and various applicants. Here are some examples of recent activity. Last week the Federal Power Commission granted licenses to Grant County Public Utility District in Washington to construct the Priest Rapids and Wanapum Dams on the Columbia. These two dams are to replace the single Priest Rapids Dam which had been originally set up for Federal construction, but was deauthorized, with administration appoval, so that the local public power agency could proceed.

A group of investor-owned utilities, after completing preliminary surveys, have applied to the Federal Power Commission to build Pleasant Valley and Mountain Sheep Dams on the Snake River below Hells Canyon. Many more projects are being studied—some with varying degrees of partnership participation, others with none. All come under FPC and State regulation.

Until this new wave of confidence in the administration policy took effect, more dams were needed than there were sponsors to build them. That situation is changing rapidly—but please remember that dams are not paid for by political ballyhoo, propaganda, or wishful thinking but by cold cash at the dam site. It takes time to work out the details of the shift of emphasis from all-Federal to Federal-plus-local responsibility. These non-Federal sponsors, consisting of local public agencies and privately owned companies, are now ready and eager to assume their responsibilities to supply the power needs of their respective service areas.

The one and only reason why these objectives may not be met is because the people who insist on Federal-or-nothing development may be able to block or delay the progress. Personally, I question the sincerity of those who continually carp about the administration's partnership program and at the same time have no solution to offer except Federal development or no development.

I think we should make it crystal clear now that any power shortage that develops in the region must be charged to those people who use every possible device to confuse, delay, and obstruct the orderly and time-honored American way of developing our water resources.

Senator NEUBERGER. Do you have any questions, Mr. Mapes?

Mr. MAPES. No; I haven't.

Senator NEUBERGER. Does either Senator Laird or Senator Dworshak have any questions?

Senator DWORSHAK. I might just add the comment that when you consider the increased use and expansion of hydroelectric generation in the Columbia River Basin and the generation of both hydroelectric and steam power in the TVA, we can point to the fact that there has been a very large influx of manufacturing concerns into both areas to take advantage of low prevailing rates of power. Of course, as you increase the demand on the part of these industrial concerns, naturally you are going to create a shortage or create a situation where you will have to build additional plants to meet the demand.

Is that a fair statement to make?

Governor JORDAN. I believe it is, sir.

Senator NEUBERGER. The fact still remains, however, that the per capita use in residences which certainly are not affected by industries is in the Northwest far higher than in other parts of the United States—if I am not mistaken—use by the residential users, in the homes, and on the farms.

Senator DWORSHAK. I question whether that would be largely responsible for any shortage of power in either the Columbia River Basin or TVA if it were not for the increased industrial demand.

Senator NEUBERGER. Yes, and I will say that increased industrial demand has been a vast benefit to the region. We have had industries come in with very substantial payrolls, high weekly wages, very great local and State taxes paid for the support of school districts and other local responsibilities of government. So I think it has been to their advantage.

Senator DWORSHAK. I am not arguing that point. I simply wanted to point out when we do create these emergencies we have a full understanding of what is partially responsible for that emergency which is contingent upon greatly increased demands for power.

Senator NEUBERGER. Senator Laird, you don't have any questions?

Senator LAIRD. No.

Senator NEUBERGER. Mr. Mapes, do you have any?

Mr. MAPES. I have none.

Senator NEUBERGER. Governor, we appreciate your coming here. I just want to say, speaking for myself, that I am very pleased at the step which has been taken today by the United States Government and by the Canadian Government to raise these very important negotiations beyond the IJC level to that of the executive department level. I am gratified that it carries out at least one recommendation of my report to the chairman of the committee.

I wish all possible success to the participants in these negotiations because of their great importance not only to the Pacific Northwest and the State of Oregon, but all of Canada and all of the United States. I think they are extremely vital and extremely significant.

(The following correspondence is included at the request of Senator Neuberger:)

UNITED STATES SENATE, *July 5, 1956.*

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

DEAR SENATOR MURRAY: I have seen the stenographic transcript of the hearings which were held before the Interior Committee on May 23, 1956, on the subject of upper Columbia River development. The cover of this copy of the transcript bears the notation: "Corrected by Mr. Jordan." I am writing to protest certain changes made by or on behalf of Governor Jordan in the actual text of his testimony before the committee, insofar as they go beyond grammatical corrections to alter the substance of the actual discussion.

I shall cite only one example. I asked Governor Jordan about a speech he made in November 1955 in Salem, Oreg., in which he made a bitter partisan attack on supporters of Federal development rather than private or "partnership" hydroelectric development in the Columbia River Basin. I asked him whether he considered such a partisan speech on a matter of crucial domestic political controversy consistent with a role as chief international negotiator for the interests of the Federal Government in the very Columbia River system about which he was speaking. This was Governor Jordan's reply, as reported by the stenographer:

"It is a question of judgment. I might have been a little indiscreet and a little forceful, although I hate to feel that in any position I hold I was circumscribed in what I believe, Senator."

As "corrected" by Governor Jordan, the transcript now reads (p. 215):

"It is a matter of opinion. My comments were directed against those who would have Federal development or no development. I hate to feel that in any position I hold I was circumscribed in stating what I believe, Senator."

In 1 or 2 other instances, with which I shall not burden this letter, whole new sentences have been written into the transcript to score what is obviously intended to be a political point, which Mr. Jordan had not happened to think of in the witness chair.

I have no objection to the correction of the record where it is necessary for the accuracy or completeness of the data presented, or for grammatical clarity. I do object to the elimination of statements considered, in retrospect, to have been better left unsaid, and to the substitution or addition of new ones deemed more favorable politically. I have made no such changes in my own extensive part of the discussion.

Governor Jordan's admission that his Salem speech was "a little indiscreet," in light of his high role in our international relations, was reported in the press. These reports were accurate. I am writing this letter so that the record on which these reports were based will not have been retroactively superseded by alterations in the guise of "corrections."

With best regards.

Sincerely,

RICHARD L. NEUBERGER.

INTERNATIONAL JOINT COMMISSION,
Washington, D. C., July 6, 1956.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

DEAR SENATOR MURRAY: Senator Neuberger has sent me a copy of his letter to you dated July 5, 1956, protesting certain corrections and additions offered for the transcript of hearings before the Interior Committee on May 23, 1956.

I am quite willing that my remarks go into the record exactly as I made them, without alteration, if this same rule is to apply to the entire transcript. I do hope, however, that the list of United States storage projects now under scrutiny which I have provided will be admitted for the record.

The record is loaded with material added for the purpose of supporting Mr. Neuberger. In the interest of providing something like equal treatment, may I respectfully request that the enclosed editorials from various newspapers in the Pacific Northwest which support my position be also included in the printed record.

Sincerely yours,

LEN JORDAN.

[From the Spokesman-Review, October 6, 1955]

JORDAN TAKES STAND ON CANADIAN DIVERSION

Serious injury to United States interests would result if the Canadians proceed with certain proposals for the diversion of Columbia River Basin waters which flow into this country.

This possibility was well documented the other day when Len Jordan, Chairman of the American Section of the International Joint Commission, addressed an Ottawa meeting of the Commission. The former Idaho Governor outlined the American point of view. He backed it up with figures which showed just how several large power dams on this side of the boundary might be deprived of needed water.

The Canadian plans have not been finalized, and considerable engineering work needs to be done before they themselves know whether the scheme to channel about 15 million acre-feet of water from the Kootenay and the Columbia Rivers into the all-Canada Fraser River would be to their own interests.

Mr. Jordan has rightfully protested the scheme and rejected the idea that this country should engage in joint studies on terms suggested early this year by Gen. A. G. L. McNaughton, Canadian Chief of the IJC.

Mr. Jordan pointed out how the United States Government has made huge investments in such projects as Grand Coulee, McNary, Chief Joseph and the Dalles Dams—on the basis of earlier Canadian-American understandings which assured that the water would be available to turn the generators which produce a great share of the Northwest's hydroelectric power.

He will not consent to any joint studies or action that would be against the public interests from the point of view of the United States.

What effect Mr. Jordan's policy statement will have upon the Canadians cannot be foretold. His warning ought to be received, however, in the friendly and aboveboard manner in which it was issued.

The issues can and should be reconciled without injury to either nation. The fact that our American representative speaks plainly and in defense of American interests is a first step toward the new understandings that must be achieved if our Northwest river projects are to be productive, and if our past harmonious relations with Canada are to be maintained.

[From the Idaho Statesman]

ON WHAT OTHER BASIS?

Oregon Senator Neuberger's comic opera demand that former Idaho Governor Len Jordan be fired from his position as Chairman of the American Section of the International Joint Commission is so patently a piece of political pettifoggery that it seems much more likely to backfire than to serve whatever purpose he may have had in mind.

The Joint Commission just now is engaged in negotiations looking toward settlement of questions that stand in the way of the development of the Columbia in both Canada and the United States. Members of the Commission differ sharply on how much the United States should pay for downstream power benefits resulting from plants proposed in Canada. But there's no good reason for believing that these questions won't be resolved amicably and satisfactorily all 'round.

And there's no shadow of an excuse in the continuing negotiations for the demand by Oregon's volatile and vociferous Senator that Congress should determine whether Jordan's "profound bias and prejudice on issues of Federal power policy" should disqualify him from representing the United States in these negotiations.

It's true enough that Idaho's former Governor and the Oregon Senator are as far apart as the poles in their views on Federal power policy, but what possible bearing can that have in the negotiations with the Canadians? That can be of no concern at all to them. What they are interested in is making the best deal they can for themselves in working out the problem that involves the interests of both countries.

It's Mr. Jordan's position that the problem is not to be solved by politicians, but by engineers, and with that idea the Canadian seems to be in accord.

On any other basis whatsoever would Oregon's Senator want the question to be presented, and solved?

[From the Spokesman-Review, Spokane, Wash., March 11, 1956]

CALLISON MARKS—COLUMBIA COMMENT

DICK'S CANADIAN DIVERSIONS

Senator Dick Neuberger, of Oregon, has been instrumental in getting a Senate investigation of Eisenhower administration policy on development of the upper Columbia River Basin.

This will be a probe into American-Canadian relations. It is scheduled to start March 22 and it will be conducted by the Senate Interior Committee, headed by Senator James Murray, of Montana, in cooperation with a specially appointed subcommittee of the Senate Foreign Relations Committee.

Already named on the latter group are such men as Humphrey of Minnesota; Morse, of Oregon; Mansfield, of Montana; Langer, of North Dakota; Wiley, of Wisconsin; and Aiken, of Vermont.

The investigation is one outgrowth of a report made by Mr. Neuberger after a visit to British Columbia late last year. He expressed alarm over the status of Canadian-American agreements concerning the possible diversion of waters of the Columbia and Kootenay.

The relations between the 2 nations on water problems are handled, and have been for many years by the International Joint Commission, which has 3 members from each country.

The head of the Canadian Section is Gen. A. G. L. McNaughton. The head of the American Section since early in 1955 is ex-Gov. Len B. Jordan, of Idaho.

For many years previous the job was occupied by an elderly, retired Senator from Kentucky, who was not noted for aggressiveness or accomplishment in a field requiring great understanding of complex engineering, legal, diplomatic, and economic factors.

Mr. Jordan has had to catch up, in a few brief months, with the long-developing snafu in Canadian-American water relations on the Columbia, the St. Lawrence, and other cross-border streams. He has also had to create and guide new water policies in conformity with the aims of the Eisenhower administration.

Some of these policies have been attacked by men like Senator Neuberger who frequently advocate total federalization of the Nation's power resources.

It is not surprising, therefore, to see Mr. Neuberger and like-minded Senators using the proposals for Canadian water diversion as a means for diverting public opinion in this country.

Senator Neuberger's direct target in this inquiry is Mr. Jordan. In his report, the Oregon Democrat charges the Idaho Republican with "profound bias and prejudice on issues of Federal power policy." The freshman from Portland also took occasion to criticize "the present administration's irresponsible abandonment of great floodwater storage reservoirs such as Hells Canyon."

If the Murray-Neuberger-Humphrey-Morse committee can conduct a fair and objective inquiry into international water resource development programs and policies affecting the Columbia, some good might be accomplished.

If the committee's prime purpose is to "get" Len Jordan and to revile and ridicule the Eisenhower administration, the committee could retard progress on this side of the border and confound the Canadians for several years to come.

Northwest citizens have been observing how certain congressional investigations and hearings on resource matters have been conducted during the last year. If committee members and staff assistants expect to "stack" the hearings with one-sided testimony, this Canadian diversion is apt to be as big a fiasco as the 1955 Senate hearings on the high Hells Canyon Dam bill, or the House hearings on the Oregon timber-mining claims.

These excursions were apparently originally planned for their propaganda effects. Both of them backfired miserably when all the evidence in each case finally became known.

Dick Neuberger's Canadian diversions will be watched with intense interest throughout the Columbia River Basin on both sides of the border and on both sides of the political fence in this country.

Don't discount the ability of IJC Chairman Len Jordan to keep the record straight and the aims clear in plans for joint beneficial development of the Columbia's resources, in accordance with the policies of each of the Governments concerned.

[From the Spokesman-Review, Spokane, Wash., March 25, 1956]

CALLISON MARKS—COLUMBIA COMMENT—NEW RIVER STUDIES AWAITED

What is delaying American-Canadian agreements on development of Columbia River water resources? What's holding up the Libby Dam project on this side of the border, or the Mica Creek project in British Columbia? And how about that Kaiser-sponsored proposal to store water in the Arrow Lakes to increase power production at downstream dams in the United States?

Len B. Jordan, Chairman of the American Section of the International Joint Commission, provided some answers to such questions last week when he testified in Washington, D. C.

Jordan was called before Senate Committees on Interior Affairs and Foreign Relations as a witness in the hearings, first suggested by Senator Dick Neuberger, on Columbia River water problems of mutual concern to both the United States and Canada.

The former Governor of Idaho outlined to the committees the background of the international negotiations. In brief, his testimony revealed that the American Government recognized the need for a comprehensive engineering investigation of the river, on both sides of the border, back in 1943.

In 1944 the two Governments agreed upon terms of a "reference," which set up an international Columbia River engineering board to direct engineering studies and field investigations. Then, while the Canadians cooled their heels over the matter, the United States Army engineers revised their famed 308 report. Their studies took several years and were published as House Document 531 in 1943.

It took years for the Canadians to awaken to the need of gathering their information. Their studies are now underway. In March of last year, Gen. A. G.

L. McNaughton, Canadian Chairman of the IJC, said that "about 2 more years of fieldwork lies before the various agencies and then after that about 1½ years for the compilation, the writing and the editing of the reports."

This means the Canadian study may not be available until late in 1958—10 years after the Americans submitted their 531 report.

In the meantime, the Army engineers have recognized that some of the 1946–48 data in the 531 report are now out of date. The corps is now in the midst of revising that report. The new river studies on this side of the border should be available before the Canadian counterpart.

Field hearings will be conducted this spring by the Army engineers at such places as Spokane, Missoula, Boise, and Portland. These will, of course, be in addition to the actual engineering work at various dam sites along the Columbia and its tributaries in this country.

The Libby propect is not being held up on this side of the border. The Canadians are still checking into the Mica Creek project, and into possible river diversion plans that would affect the use of Columbia water downstream.

So far as the Arrow Lakes project is concerned, the IJC has no actual jurisdiction over the matter, since the proposed Kaiser Dam would be built wholly within Canada, and the added power it would provide would be generated wholly within the United States. The IJC is keenly interested, Mr. Jordan says, but has no jurisdiction over the project.

Mr. Jordan's testimony provides a new perspective to American-Canadian relations on the Columbia's potential.

It answers very well the claims, made by Senator Neuberger, that the IJC and Mr. Jordan are at fault in not securing "action" on joint development plans.

Actually, all the plans have not been made, especially on the Canadian side. The river studies and the engineering data are being eagerly awaited here and in Canada—a fact that Mr. Neuberger certainly must have known before he started the clamor on this subject, evidently for political purposes this year on this side of the boundary.

[From the Oregon Journal, December 21, 1955]

NEIGHBORLY QUARREL ON WATER

Senator Neuberger's gratuitous attack on Len Jordan, United States representative on the United States-Canadian International Joint Commission—simply because the former Idaho Governor does not agree with him on the high Hells Canyon issue—is entirely unjustified.

Furthermore, it is extraneous to the real import and basic content of the Neuberger report on the current impasse between the two great countries over water and power policy and projects in which the two countries have great and mutual interest.

When Neuberger, who has just completed an exhaustive on-the-ground survey of Canadian projects and points of view, gets above his Hells Canyon prejudice, however, he places himself in substantial agreement with Jordan on at least some of the projects at issue between ourselves and our Canadian neighbors.

For example, he agrees generally with Jordan's contention that diversion of a substantial part of the flow of the upper Columbia into the Fraser River in Canada and, to a lesser degree, the diversion of the Canadian Kootenay into the Columbia (thus reducing this river's flow into Montana) would materially damage United States projects below the border.

"Diversion of substantial parts of the natural flow of these great rivers would radically change the economic geography of the Pacific Northwest in both countries," Neuberger says in his report to Senator Murray of the Senate Interior and Insular Affairs Committee. "It would forever foreclose the full development of the Columbia Basin in the United States. This is the magnitude of the issues in the negotiations between the Canadians and ourselves."

Neuberger also cites the potential damage that may be done to salmon runs in the Fraser, if Canada presses its Fraser project to completion. Both the United States and Canada have a great stake in these runs. He also believes diversion of the Columbia would damage lower Columbia salmon runs.

Jordan himself directly challenged Canadian diversion plans and downstream benefits claims in a hard-hitting speech at Missoula, Mont., last May. He branded them "fantastic" and said they would force abandonment of the Libby and other below-the-border projects involving Canadian storage.

Thus the two agree in part, including the fact that Libby Dam is a key power and storage project.

Undoubtedly there will be another parting of the ways, however, on Neuberger's contention that United States-Canadian negotiations might profitably be taken out of the hands of the advisory international joint commission and assumed by "policymaking executive departments themselves." Failing in this, Neuberger would recommend that appointments to the International Joint Commission be made subject to Senate confirmation.

We are completely out of sympathy with Senator Neuberger's obvious efforts to discredit and unseat Jordan (an able and conscientious man) because of the Hells Canyon issue.

We agree, however, that settlement of the vital issues between the United States and Canada, as they affect great power projects on both sides of the border, is imperative.

And if a Senate investigation (which Neuberger advocates) of the impasse in negotiations between the two countries would serve to focus public attention on and speed up these negotiations, we're for that, too.

The current impasse is hazardous to the orderly development of Columbia projects on both sides of the border.

UNITED STATES SENATE,
July 10, 1956.

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
Senate Office Building, Washington, D. C.

DEAR SENATOR MURRAY: I am writing you further in connection with the changes in the record of the hearings on upper Columbia River development, which were made by Chairman Jordan, of the International Joint Commission, in his testimony as reported in the verbatim stenographic transcript. Governor Jordan has sent me a copy of his letter to you, in which he asks that certain material be added to the record.

In his letter, Governor Jordan charges that "the record is loaded with material added for the purpose of supporting Mr. Neuberger," and asks for the inclusion of several newspaper editorials critical of me "in the interest of providing something like equal treatment."

Governor Jordan's complaint is unfounded. A brief examination of the record immediately reveals that the bulk of the evidence taken at the hearings was from administration witnesses, including first and foremost Governor Jordan, and that all material they cared to submit was accepted for the record. I could have placed in the record many instances of newspaper comment, from both sides of the international boundary, on the manner in which the upper Columbia River negotiations have progressed under the chairmanship of Governor Jordan, but I refrained from doing so. Nevertheless, I have no objection whatever to the inclusion of the editorials submitted by Mr. Jordan in the hearing record.

However, I must point out that addition of supporting material to the record is very different from editing out spoken testimony actually given and adding new sentences which were never actually spoken. Perhaps I, too, could think up some politically clever remarks which I might wish I had made at the hearings; but I have not changed my actual remarks as recorded.

It was some flagrant instances of this sort of editing by Governor Jordan to which I objected in my letter to you of July 5, and not the correction or addition of substantive evidence. In his letter, Governor Jordan seeks to obscure this difference. I, therefore, ask that this exchange of correspondence concerning the transcript be itself included in the record of the upper Columbia River hearings.

With best regards.

Sincerely,

RICHARD L. NEUBERGER,
United States Senator.

(Documents referred to earlier by Senator Neuberger, to be included at the conclusion of the testimony, follow:)

NOTE.—These documents consist of a letter to Senator Murray from the Northwest Public Power Association, with exhibits.

NORTHWEST PUBLIC POWER ASSOCIATION, INC.,
Vancouver, Wash., April 6, 1956.

Re upper Columbia River

Senator JAMES E. MURRAY,
Chairman, Senate Interior and Insular Affairs Committee,
Senate Office Building, Washington, D. C.

DEAR SENATOR MURRAY: Your kind invitation to testify in regard ot proper development of water resources of the upper Columbia River Basin is very much appreciated.

The Northwest Public Power Association comprises rural electric cooperatives, utility districts, and city electric systems of Alaska, Montana, Oregon, Washington, and Idaho which provide electricity to about 1,750,000 people. These systems own about $700 million in electric utility plant including about a million kilowatts of generating capacity.

In calendar year 1955, our systems paid about $20 million into the United States Treasury for power purchased from Federal dams including $18.8 million from dams in the Columbia River Basin, an increase of $3 million over 1954. Thus we help repay Federal investment in these projects.

On a fiscal year basis our systems have increased their payments to Bonneville Power Administration as follows: $4.3 million in 1948, $8.4 in 1950, $12.9 in 1952, $17.6 in 1955, and as mentioned above, for calendar year 1955 this reached $18.8 million. It will easily reach $30 million in 1960. We need more power and are able and willing to pay for it.

The largest cost of doing business for our utilities is that of wholesale power. However, as nonprofit, consumer-owned systems, we attempt to sell at the lowest possible retail level. During 1955, for instance, 19 of our utilities sold electricity for residential purposes at an average rate of less than 1 cent per kilowatt-hour, as compared to the national average of 2.6 cents per kilowatt-hour. Our systems have also carried most of the burden of rural electrification.

SUMMARY OF TESTIMONY

We favor optimum, economic development of the entire Columbia River Basin in both the United States and Canada as a unit:

1. Power and flood control go hand in hand, both being achieved by upstream storage. Half the power potential depends on provision for upstream storage.

2. The critical and controlling factor in planning the comprehensive development of the water resources of the Columbia River Basin is how much flood control is needed. Congress should define the flood control objective for the Columbia River Basin.

3. The international flood control problem requires concerted action by the United States and Canada.

4. We deplore the lack of progress in negotiations with Canada and the absence of a responsible agency to handle United States negotiations. We suggest that the Bonneville Power Administration be made a participant in future negotiations with Canada.

BOTH POWER AND FLOOD CONTROL DEPEND ON UPSTREAM STORAGE

In some State conflicts arise as to whether dams should be built and operated for hydroelectric power or be kept empty and ready to catch the raging waters of a cloudburst. Fortunately in the Pacific Northwest this conflict does not exist. Flood control and power are complementary and go hand in hand.

In summer the Hungry Horse Dam in western Montana captures and holds back the floodwaters from the melting snow. Then in winter, when the need for electricity is greatest, the water is released to create power not only at the Hungry Horse powerhouse but also at each of the downstream dams at each of which stand turbines idle for lack of water. By April the reservoir is again empty. Hungry Horse is a double-duty dam converting wasteful summer floodwaters into precious winter power. Thus storage dams make "good water out of bad water."

Mr. Ben Torpen of the Corps of Engineers in his paper of December 12, 1951, delivered before the Columbia Basin Interagency Committee (exhibit A), pointed out that half the power potential of the Columbia River Basin depends on up-

stream storage. Without adequate upstream storage most of the water rages down the river and is wasted over the spillways while in winter not only are the same spillways dry but also most generators stand idle. In the 6 summer months the Columbia discharges an average of 73 percent of its annual flow leaving the 6 winter months with only 27 percent of the flow. Yet the people need more power in winter. The historical extremes of flow at The Dalles have been as low as 36,000 second-feet and 1,240,000 second-feet. These concepts are further developed in a series of four articles by myself which are enclosed (exhibit B).

The dimensions of the Columbia River are so vast that it will be desirable to devise yardsticks for use in this discussion.

We have long said that the Pacific Northwest needs a new Bonneville Dam of about 500,000 kilowatts each year. Today our load growth calls for one and a half Bonneville Dams a year. Grand Coulee Dam is worth 4 Bonnevilles, Chief Joseph is the equivalent of 3, McNary is the equivalent of 2, and so on. The 30,000,000 kilowatt potential of the Columbia River is equal to 60 Bonneville Dams of which the equivalent of about 8 are built. But Bonneville Dam is a run-of-the-river project and is suitable as a yardstick only for power. We want a yardstick for flood control.

CONGRESS SHOULD DEFINE THE FLOOD-CONTROL GOAL

The critical and controlling factor in planning the comprehensive development of the water resources of the Columbia River Basin is how much flood control is needed. Congress should define the flood-control objective for the Columbia River Basin.

How does one measure flood control? Again the Hungry Horse Reservoir comes in handy. It has a useful storage of 2,980,000 acre-feet or, in round numbers, 3 million acre-feet. The average annual flow of the Columbia River into the Pacific Ocean is 180 million acre-feet or, using the Hungry Horse Reservoir as a dipper, the equivalent of 60 reservoirs of water. Hungry Horse can hold one-sixtieth of the annual flow of the Columbia. However, we are concerned only with the flow of the Columbia at The Dalles, which is two-thirds of the total and thus the equivalent of 40 reservoirs of water.

However, a million acre-feet of storage in one place may be much more effective than on some other tributary. The storage must be advantageously spotted among the tributaries. This can best be done by measuring streamflow of all tributaries at time of maximum flood, which is what the Corps of Engineers has done.

At full flood the South Fork of the Flathead River reaches a crest of 40,000 second-feet of discharge into Hungry Horse Reservoir. This compares with the all-time record flood of the Columbia River measured at The Dalles of 1,240,000 second-feet. Thus the South Fork represents 1 part in 31 of the total flow.

Thus the Hungry Horse Dam may be used as a yardstick of reducing total flood flow by 40,000 second-feet as measured at The Dalles. Thirty-one Hungry Horse Dams would thus theoretically capture the entire flood and dry the river bed. But how many such dams should actually be built?

The Corps of Engineers has prepared a table to show how the 1894 flood has on the one hand been aggravated slightly by construction of downstream levees, and on the other hand has already been reduced from 1,240,000 to 1,110,000 second-feet by existing storage, including Hungry Horse Dam. Thus today we have in operation storage sufficient to cut 130,000 second-feet from the record flood or the equivalent of 3¼ Hungry Horse reservoirs.

The 308 report of 1948 aimed at reducing the 1894 flood to 800,000 second-feet, leaving the rest of the job to levees. Since 1948, however, new record floods have hit New England and the Missouri River. There is no assurance that the 1894 flood cannot be exceeded. The elimination of most of the flood storage at John Day Dam and Priest Rapids Dam necessitates providing a reserve of protection. Another factor is the upsurge in the economy of the Pacific Northwest, which makes feasible a larger flood-control program, especially in combination with power storage projects.

In recent months, as a member of the Corps of Engineers 308 General Advisory Committee, I have become increasingly concerned with the inadequacy of the old target of reducing the 1894 flood to only 800,000 second-feet at The Dalles.

Effect of storage on 1894 flood

	Gross usable storage (million acre-feet)	Storage used, 1894 flood (million acre-feet)	Effective storage at The Dalles (million acre-feet)	Flow at The Dalles (cubic feet per second)	Vancouver Weather Bureau gage (feet)	Stage reduction at Vancouver (feet)
Natural (actual)	0	0	0	1,240,000	33.4	
Confined by levees	0	0	0	1,240,000	34.3	
Existing storage	11.1	4.9	2.5	1,110,000	32.3	2.0
H. Doc. 531 with setbacks	13.5	10.4	9.4	920,000	29.0	5.3
Full MCP[1] as per H. Doc. 531	27.0	20.9	17.3	800,000	26.6	7.7
Tentative United States program	26.0	22.3	19.2	780,000	26.1	8.2
Tentative United States program plus Canada storage	37.5	31.6	25.2	690,000	24.0	10.3
Minor damage only			32.5	600,000	21.7	12.9

[1] Main control plan of report as published in H. Doc. 531.

It is now my strong view that this target should be set at 600,000 second-feet. The aforementioned table of the Corps of Engineers shows that even at 600,000 second-feet flow at The Dalles, the Vancouver gage would show 21.7 feet or a reduction of only 12.9 feet in the flood crest. Levees would still be needed. In fact, prudence would probably require in the long run that the levees be adequate to handle an 800,000 second-feet flow while at the same time the upstream storage should be adequate to reduce the 1894 flood to 600,000 second-feet. That is the kind of reserve which should be built into the flood-control system.

This table is a ladder of our progress toward controlling the Columbia River. Of the many multiple purposes of water-resources development the most critical is flood control. Power needs should govern the timing of the flood-control works. But every step in the direction of upstream flood storage is also a step toward more power.

To reduce the 1,240,000 second-feet flow to 600,000 requires skimming off 640,000 second-feet or the construction of 16 Hungry Horse dams or equivalent. Already 3¼ are completed and in operation. The job is 20 percent done. We know just where we stand on the ladder of progress; 80 percent of the job remains to be done. This job requires concerted action by both the United States and Canada because the flood problem is international in nature.

INTERNATIONAL FLOOD-CONTROL PROBLEM

The Similkameen River on May 30, 1948, reached a flood flow into the United States measured at the international boundary of 38,700 second-feet causing extensive devastation in Okanogan County and contributing to the third greatest flood of record for the lower Columbia. In that year over $100 million of flood damage was caused on the United States side of the boundary.

The Similkameen River flow is about the same as that of the South Fork of the Flathead. The topography suggests it as one of the logical places for 1 of those 16 Hungry Horse dams. In fact, a dam has been planned on the Similkameen but has, in my opinion, unjustifiably been discarded.

On September 10, 1953, the subcommittee on comprehensive program of the Columbia Basin Interagency Committee submitted a report which listed the Similkameen Dam with 1,620,000 acre-feet of active storage. The project would be located 7.3 miles above the mouth. It would be earth fill, 260 feet high and 1,200 feet long. The report indicated that more detailed study might show that a concrete dam might be more economical. A powerhouse would have 84,000 kilowatts capacity. Irrigation benefits would also be realized. One arm of the reservoir would extend 10 miles into Canada.

Within the past month, I am advised, the Corps of Engineers has been considering a greatly reduced dam on the Similkameen River called the Nighthawk Dam with only 30,000 acre-feet of storage. It would produce no power. Its reservoir would not extend into Canada. In my opinion, the building of the Nighthawk Dam would be tragic.

The Similkameen Dam illustrates the international problem, but it is only 1 of about 20 streams crossing the boundary within the upper Columbia River Basin. The Kettle River crosses the boundary four times, the Kootenai River crosses the boundary twice.

The third greatest flood of record occurred on the Columbia on May 31, 1948, peaking 1,010,000 second-feet at The Dalles. The discharge remained above 900,000 second-feet for 17 days and above 500,000 second-feet for 42 days. About 43 percent of the floodwater came from Canada, but this water went across the boundary back and forth until the aggregate flow across the boundary exceeded the 100-percent flow measured at The Dalles.

Table showing international flood problem

Stream	Date	Discharge (second-feet)
North Fork Flathead River	May 23, 1948	14,600
Kootenai River at Newgate, British Columbia	May 28, 1948	91,900
Moyie River at Easport, Idaho	May 24, 1948	8,030
Kootenia River at Bonners Ferry, Idaho	May 27, 1948	139,000
Pend Oreille River near Metaline Falls	June 13, 1948	171,300
Columbia River at boundary	June 12, 1948	550,100
Kettle River near Laurier, Wash	May 29, 1948	35,000
Kettle River near Ferry, Wash	do	21,200
Okanogan River at Oroville, Wash	June 2, 1948	3,480
Similkameen River at Nighthawk	May 30, 1948	38,700

Once this 43 percent flow reaches the main stem of the Columbia River within the United States the possibility of controlling the flood is over. A little storage in Grand Coulee, John Day, and Priest Rapids Reservoirs can be provided but it is insignificant. The job of flood control basically must be done in the headwaters near the snowfields. Thereby the region also achieves local flood control at such trouble spots as Bonners Ferry, the Clearwater Valley, the Flathead River above Kalispell and many others.

According to a March 13, 1952, FPC list of potential power projects within the United States (exhibit C) the potential upstream storage capacity for the Columbia River is about 61 million acre-feet. An additional 20 to 24 million acre-feet is available in Canada for a maximum total of 85 million acre-feet.

Under the goal of reducing the 1894 flood to 600,000 second-feet, it appears the region will need about 48 million acre-feet of storage or 16 Hungry Horse dams. So much for the physical possibilities. However, on the next go-around each project must be tested for economic feasibility. This can be expected to eliminate about 20 percent of the possibilities. Further study of foundation conditions will eliminate others. Political pressures will come into play. It does not take long to cut the 85 million to less than 48 million acre-feet of storage. At this stage one can only fight for every upstream storage site in both the United States and Canada.

The highly conservative main control plan prepared by the Corps of Engineers in 1948 has been cut in half by the elimination of high Hells Canyon, Glacier View, and most of the storage at John Day Dam and Priest Rapids Dam. Thus we have reached an emergency point in our planning. We now have no plan. The great 308 report for comprehensive development of the Columbia River has been gutted. Simultaneously we find that its goal of 800,000 second-feet flow is not adequate.

Before concluding this discussion of upstream storage may I call attention to two diagrams showing downstream benefits of the completed Hungry Horse Dam (exhibit D) and the proposed high Hells Canyon Dam (exhibit E). Note that of the 810,000 kilowatts of firm power added to regional power supply by Hungry Horse Dam, 197,000 kilowatts is at site and 613,000 kilowatts is at downstream projects. The Hells Canyon diagram shows 686,000 kilowatts at site and 436,000 kilowatts downstream for a total of 1,122,000 kilowatts but as I showed in our recent State of Oregon testimony on Hells Canyon (exhibit F) there will be added 391,000 kilowatts downstream benefits at Nez Percé, Asotin, and Clarkston Dams to make the new values for the high Hells Canyon 686,000 kilowatts at site and 827,000 kilowatts downstream benefits or a total of 1,513,000 kilowatts and this figure is subject to further upward adjustment.

Exhibits G, H, and part of F discuss financial aspects of upstream storage projects which are sufficiently striking that the committee may wish to include them in the record.

FEDERAL RESPONSIBILITY FOR CANADIAN NEGOTIATIONS SHOULD BE FIXED

We deplore the lack of progress in negotiations with Canada and the absence of a responsible agency to handle United States negotiations.

We submit for consideration by your committee the question whether it might not be appropriate for the proposed power negotiations to be conducted by the two large and important power agencies concerned, namely, the Bonneville Power Administration on the part of the United States and the British Columbia Power Commission on the part of the Dominion of Canada. At a minimum we inquire whether it would not be advisable for these agencies to be active participants in these urgently needed negotiations.

It appears to us to be desirable for the agencies directly concerned to be in such negotiations. It is not good public administration for the Federal Power Commission or the Corps of Engineers to be exclusively in control of decisions when the primary burden resulting from those decisions will fall upon the power customers of the Bonneville Power Administration. We think the Bonneville Power Administration is the proper claimant agency in power matters and the Corps of Engineers is the proper claimant agency for flood control matters. The Federal Power Commission may be retained as a third party and perhaps the Bureau of Reclamation as a fourth. Possibly the vehicle for such participation would be the International Columbia River Engineering Board.

In conclusion may we express our appreciation to the Committee on Interior and Insular Affairs and the Committee on Foreign Affairs for the opportunity to testify on these matters. This area appears to be a no man's land of public administration. It is hoped these hearings will result in the fixing of responsibility and in stimulating the development of water storage in the upper Columbia River Basin for flood control and power generation for the greatest mutual benefit of the people of both the United States and the Dominion of Canada.

Thank you.

Respectfully submitted.

GUS NORWOOD.

EXHIBIT A

POWER AND COLUMBIA RIVER STORAGE: PROJECTS IN THE REGION'S POTENTIAL

(By Ben Torpen)

At your Boise meeting last month, the current status of the comprehensive plan for development of the resources of the Pacific Northwest was outlined to you. Today, I am going to give you additional background material concerning that plan and discuss briefly some of the projects considered in formulating the plan, which were not included but remain a part of the region's potential. I hope that the discussions here today will give you a better understanding and a greater appreciation of the programs outlined at the October meeting.

ADEQUATE PLANNING

Basic physical data required for adequate planning are:

1. Complete topography
2. Complete hydrological data
3. Competent geological information
4. Competent economic data.

Besides this basic data the planning agency needs sufficient time and money to analyze the many variants necessarily considered to arrive at the best solution. Editorial—Engineer News-Record—November 29, 1951: "Congress should provide more money and time for these studies."

The Columbia Basin is an enormous region and topography is still lacking in many critical areas.

THE COLUMBIA RIVER

The Columbia River has a definite annual pattern of runoff with a great outpouring of melting snows causing spring floods and a long low-water season during the dry autumn continuing during the winter months of general freeze-up throughout its mountain areas.

The earliest use made of the waters in the Columbia River Basin was for irrigation. Some storage was required on tributaries to supply irrigation water in the latter part of the growing season and over 200 dams have been built for

that purpose. At some of these dams the byproduct of hydroelectric power has been developed.

The basin has developed industrially to the point where large additional blocks of power are required annually.

There is a wide divergence between the demand for power, which is fairly constant throughout the year (although usually highest during the winter) and the availability of hydro power, which follows the pattern of runoff and is usually at a minimum in the winter. (Chart No. 1.)

As electric power cannot be readily stored it has been found desirable to achieve the same result by storing the excess water of the spring floods and release them for power during the winter months when needed.

In its original state, as explored by Lewis and Clark, the Columbia River was susceptible of complete regulation by storage. Many very favorable dam sites and reservoir sites were available throughout the basin.

The average annual runoff of the Columbia River is in excess of 150 million acre-feet, which is exceeded in the United States only by the Ohio and lower Mississippi, and for its complete regulation a total storage of about 500 million acre-feet would be required. Nearly all this enormous storage could have been provided at one time by one large dam at The Dalles, creating an inland lake larger than Puget Sound and several hundred feet deep. (Chart No. 2.)

Other enormous storages could have been developed at Saddle Mountain, Grand Coulee, Arrow Lakes, and Big Bend on the Columbia River; at the Boundary, Paradise, and Plateau sites on the Clark Fork; Bad Rock Canyon on the Flathead; the Nez Perce, and Sturgill Rapids sites on the Snake and the Kooskia on the Clearwater. These various sites were good for 5 million acre-feet to 50 million acre-feet each. There were also innumerable other sites capable of producing from 1 million to 5 million acre-feet each of storage.

STORAGE SITES

Storage sites such as The Dalles or Wallula Gap high dams are now eliminated by development in the reservoir area, the Hanford Works, Pasco, etc., and the fishing industry. Saddle Mountain storage is impossible because of Wenatchee and its orchards. Boundary was eliminated by Sand Point and the lead-zinc mines. Sturgill Rapids site is eliminated by Weiser and surrounding irrigated areas. Nez Perce is held in abeyance awaiting solution of the salmon fishery problem. That brings us to the practical consideration of site selection to meet the conditions of today.

The most natural place to seek large storage at low cost would be on the large natural lakes in the basin, of which there are many which could readily have been developed. Today, however, such excellent natural storage sites as Pend Oreille Lake, Flathead Lake, Priest Lakes, Coeur d' Alene Lake, Okanogan Lake, Chelan Lake and others have been developed to a very limited extent and eliminated from further consideration by the strongly expressed will of the people, in some cases by State legislative action.

SALMON

The salmon packing industry has long been one of our leading industries and salmon sport fishing is very popular. Many believe the dams on our rivers spell the doom of this industry and therefore oppose dams on salmon streams. For this reason dams on the lower Snake River and the Salmon River watershed are opposed. Pending solution of the fish problem, projects on these streams are postponed.

IRRIGATION

The waters of the upper Snake River and its tributaries are required for irrigation. Therefore, the upper Snake River is eliminated from consideration for large storage for flood control and power.

CANADA

There are storage sites available in Canada but there is little reason to believe that our good neighbors are less reluctant to have their farms and valleys converted to storage reservoirs than our own people. Canadians are now drilling the Big Bend Dam site and a 600-foot dam is proposed there. Perhaps 5 million acre-feet of storage would result. No time has been set for construction. We are at present negotiating through the International Joint Commission for approval of storage on the Kootenai River at Libby Dam which would inundate 6,000 acres of

Canada. Other streams with an international complex are the Kettle, Similkameen, and the Pend Oreille. Because international deliberations are very time consuming, it is not rational to consider any of these projects as immediately available, although we hope for quick action on Libby.

STORAGE REQUIRED

The Corps of Engineers main flood-control plan indicated the need of 27 million acre-feet of storage at critical locations to reduce a "1894 flood" of 1,200,000 cubic feet per second at The Dalles to 800,000 cubic feet per second—chart 3. Such storage would produce the 12 million kilowatts of firm electrical energy indicated by the phase C development of the Columbia Basin. Further flood-control storage and much more storage for power are very desirable.

Storage projects, main control plan

Site	Stream	Storage (acre-feet)
Hungry Horse	South Fork, Flathead	2,980,000
Glacier View or alternate	North Fork, Flathead	3,160,000
Libby	Kootenai River	4,250,000
Grand Coulee	Columbia River	5,120,000
Priest Rapids	do	2,100,000
John Day	do	2,000,000
Hells Canyon	Snake River	3,280,000
Pallsades	do	1,200,000
Boise River projects	Boise River	1,000,000
Payette River projects	Payette River	1,900,000
Total		26,990,000

Grand Coulee Dam is completed but only about 1 million acre-feet are available for flood control until the outlet valves are revised. Hungry Horse Dam is under construction. Other major sites considered are:

Site	Stream	Storage (acre-feet)
Nez Perce	Snake River	4,800,000
Kooskia	Clearwater	3,100,000
Elkberry	North Fork, Clearwater	1,500,000
Plateau	Clark Fork	1,000,000
Paradise	do	4,000,000
Springston	Coeur d'Alene	2,280,000
Total		16,680,000

NOTE.—See table 1.

LONG-RANGE PLANS

Long-range plans for optimum practical development of the Columbia River considered four phases of development as follows (chart No. 4):

	Million acre-feet power and flood-control storage	Firm kilowatts, at 75 percent low frequency
Phase C	26	12,600,000
Phase D	44	21,900,000
Phase E	68	28,200,000
Phase F	125	33,500,000

From this table it is obvious that large blocks of increased power from the Columbia depends largely on storage.

Let us next consider individual sites and the reasons for withholding development.

BOUNDARY

The Boundary storage site is objected to by the zinc-lead mine operators in the Metaline Falls area on the grounds that it would flood their operations below pool elevations. These objections are considered reasonable and as zinc and lead are strategic materials the project is to be postponed until the region has been mined out. Other plans to develop the 400,000 kilowatts of cheap power in the Z-Canyon have been studied. One plan utilized a 2-step tunnel plan (2mile-long tunnels at each step) and another plan considered a 9-mile tunnel to develop the full head. The latter plan is twice as expensive as a dam at Boundary.

PARADISE

The Paradise site was considered for the 308 report over others in the area for three reasons:

1. It had the best foundation conditions.
2. It submerged the least cultivated areas.
3. In conjunction with the other recommended projects it supplied the required amount of storage.

The Paradise project met with stern opposition from local residents and business people in Montana and was not recommended for immediate construction.

It may be well to reconsider this project and compare it with an alternate some 10 miles downstream near Eddy. Because storage is now known to be very elusive it may be necessary to develop any available site to its maximum potential. At Eddy the foundations are believed to be susceptible to successful treatment. There would be an additional 60 feet of head available as compared to Paradise. By raising the pool elevation an additional 25 feet and making necessary changes at the Polson powerplant it would be possible to increase the useful storage at Eddy from the 4 million available at Paradise to 7,500,000 acre-feet which, with the additional head, would result in 150,000 kilowatts added at the site and 250,000 kilowatts added downstream, a total of 1,525,000 kilowatts for the project if all downstream projects are developed, an increase of 400,000 kilowatts over Paradise.

GLACIER VIEW

Glacier View project contemplated storage of 3,100,000 acre-feet on the North Fork of the Flathead near its headwaters. One-half the proposed reservoir is on Glacier National Park lands and was opposed by the Park Bureau of the Department of the Interior, and others. For this reason it was omitted from request for immediate authorization and alternate storage is sought elsewhere, although Glacier View has a benefit-cost ratio of 1.84: 1—among the best in the Columbia Basin.

SPRINGSTON

The Springston storage site on Coeur d'Alene River would store over 2 million acre-feet with a dam only 150 feet high. Its reservoir would extend over the Osburn Fault in the Kingston-Wallace mining district and interfere to some extent with mine operations and tailings disposal at the smelters there. For these reasons it was opposed by the mining interests and is deferred until the area is mined out.

An alternate which may store 1 million acre-feet may be provided at Enaville by a dam 300 feet high. The reservoir will not interfere with the operations at Wallace. These storages would be useful throughout the Spokane and Columbia River powerplants, besides supplying flood control.

KOOSKIA

The Kooskia Dam site was selected before the Trans-Idaho Highway was constructed above Orofino. The storage site is an excellent one combining—

1. An excellent damsite.
2. Large reservoir above.
3. Heavy stream runoff.
4. Need for flood control of the heavy spring flood.

It also has several disadvantages:

1. Would submerge four communities.
2. Would submerge Indian lands.
3. Would submerge 4,000 acres of farmlands.
4. Would require relocation of the Trans-Idaho highway.

Considerations similar to those in regard to Paradise would now dictate a dam at least 100 feet higher at this excellent site to store 2 million more acre-feet of water, a total of over 5 million acre-feet of useful storage.

An alternate to Kooskia would be a 400-foot dam at Penny Cliffs on the Middle Clearwater to store 1,300,000 acre-feet. A 500-foot dam at Moose Creek to store 830,000 acre-feet. A 500-foot dam at Elkberry or Bruces Eddy on the North Fork of the Clearwater to store 1,400,000 acre-feet. It is obvious that these three dams would cost much more than Kooskia alone. (See table 1.)

SITES NOW AVAILABLE

The following sites are believed to be available with few dissenting votes:

Site	Storage	Stream
	Acre-feet	
Schafer Meadows	500,000	Middle Fork, Flathead.
Yaak River	500,000	Kootenai (tributary).
Moyie River	500,000	Do.
Nine Mile	1,000,000	Blackfoot.
Chiwawa	500,000	Wenatchee (tributary).
Miscellaneous small	1,000,000	
Total	4,000,000	

This amount of storage must be greatly exceeded for both flood control and power. Methods and procedures must be devised to secure additional storage and united efforts must be put forth to achieve the goal.

RUN-OF-RIVER PLANTS

There are a number of run-of-river power sites throughout the basin which may be developed as desired to meet the region's growing load and act as a stopgap pending other developments. These projects include the undeveloped portions of the main stem of the Columbia River, viz, John Day, Priest Rapids, Rocky Reach, and Wells. Under present storage conditions they would produce 2,750,000 kilowatts of firm power. The layout of these projects is contingent upon upstream storage to the same degree as McNary and other main stem dams. (Chart No. 4.)

On the tributaries there are also a number of potential run-of-river plants, the principal one being Spruce Park tunnel on the Middle Fork of the Flathead; Quartz Creek, Trout Creek, and Noxon Rapids on the Clark Fork; Z-Canyon tunnel project on the Pend Oreille River; Kootenai Falls and Katka on the Kootenai; Drury site on the Wenatchee.

With storage now operative and under construction these projects have a potential firm capability of 1 million kilowatts.

WITHOUT LARGE STORAGE

Without large storage floods will continue. Damages will increase in proportion to our cultural development. Without large storage the thirty-odd-million kilowatts potential of the Columbia Basin will be cut in half. (Chart No. 5.)

RESULTING ECONOMY

For a short time the undeveloped run-of-river plants will meet the power demand. Soon steam plants will be required to assist in carrying the load—either on the base or on the peaks—and the cost of power will begin a rise that will eliminate the Northwest from consideration as a site for expanding industry.

SHARING BENEFITS

Construction of projects such as those discussed today, and those included in the comprehensive plans to date, necessarily result at least in certain localities in some displacement of population, business, and utilities in those areas which must be acquired by the Government. This, of course, all requires adjustment in the lives of those directly affected, and in the economy of the region. While those whose property is taken incident to the project receive just compensa-

tion for that property under the fifth amendment of our Constitution, there are those who cannot be, or feel that they cannot be, made whole through the payment of money alone or who suffer damages which are without the scope of just compensation and who accordingly resist the project with whatever means are available ot them. Although under our concept of Government, we reseolve such conflicts on the basis of the greatest good for the greatest number, there are ways and means of ameliorating the impact of displacement upon those whose homes and businesses lie within the project area. Generally the advantages of the projects' construction to the area are much greater than the disadvantages. Nonetheless great deference is given the views, opinions, and desires of the local residents in an area in which a project is proposed. The projects included in the existing comprehensive program were selected after the most careful consideration of all these viewpoints as expressed by the people and represent an optimum of compromise consistent with the attainment of the objectives sought. However, I believe that many of the objections to some of the projects could be readily removed and resource development furthered by a more direct sharing of the benefits which flow from these great projects with those more immediately affected thereby. A step in this direction may be a sharing of the benefits through—

1. Allocation of power to a State.
2. Preferential rates.
3. Payments in lieu of taxes.
4. Liberal severence damages.
5. Generous reconstruction of public utilities.

LAW—RECENT ACT

A recent law in regard to acquisition of lands and property for military purposes provides for reimbursement to landowners for expenses and other losses and damages incurred, in an amount not to exceed 25 percent of the value of the land.

SUMMARY

Flood control of the Columbia River requires large additional storage. As of today there is practically no flood-control storage operative. At least 27 million acre-feet is required and much more is desirable.

Increased power on the Columbia depends upon storage. Without vastly increased storage the power output of the Columbia Basin will be cut in half.

Procurable storage sites are increasingly difficult to find. Adverse factors are—

1. Cultural development.
2. The fish problem.
3. Mining areas.

Spreading of benefits may provide a key to some sites. Early solution of the fish problem is necessary to open the Snake and its tributaries to development.

Completion of the topographical mapping of the basin is a necessity to reveal all storage possibilities, especially in headwater areas.

The CBIAC has the responsibility through its constituent agencies of developing the Columbia Basin. This requires a facing up to the problem of increased storage, and the full cooperation of all agencies, both State and Federal, to accomplish that end.

TABLE I.—*Project data, phase C–2 system*

	Libby [1]	Glacier View [1]	Paradise [1]	Boundary [1]	Nez Perce [1]	Kooskia [1]	3-dam alternate to Kooskia [2]	70-dam alternate [2]
Storage.....acre-feet	4,100,000	3,160,000	4,000,000	.....	4,800,000	3,100,000	3,530,000	2,675,000
At site prime.....kilowatts	244,000	96,000	312,000	482,000	850,000	243,000	366,000	.....
Downstream prime.....do	577,000	228,000	471,000	.....	402,000	257,000	354,000	266,000
Total prime.....do	821,000	324,000	783,000	482,000	1,252,000	500,000	720,000	266,000
Annual power benefits at $26 per kilowatt (D. S. Inst. costs deducted)	$19,830,000	$7,773,000	$18,712,000	$12,500,000	$26,228,000	$10,995,000	$15,800,000	$5,850,000
Other annual benefits	1,883,000	715,000	1,329,300	.....	1,806,000	561,000	640,000	485,000
Total annual benefits	21,713,000	8,488,000	20,041,300	12,500,000	28,034,000	11,556,000	16,440,000	6,335,000
Capital cost at site	258,659,000	102,084,000	265,569,000	168,740,000	449,232,000	185,317,000	500,000,000	750,000,000
Annual cost	11,139,000	4,609,000	11,726,000	7,864,000	20,789,000	8,301,000	22,400,000	33,600,000
Benefit-cost ratio	1.95:1	1.84:1	1.7:1	1.6:1	1.34:1	1.4:1	0.7:1	0.2:1

[1] From 308 report.
[2] Very preliminary estimate.

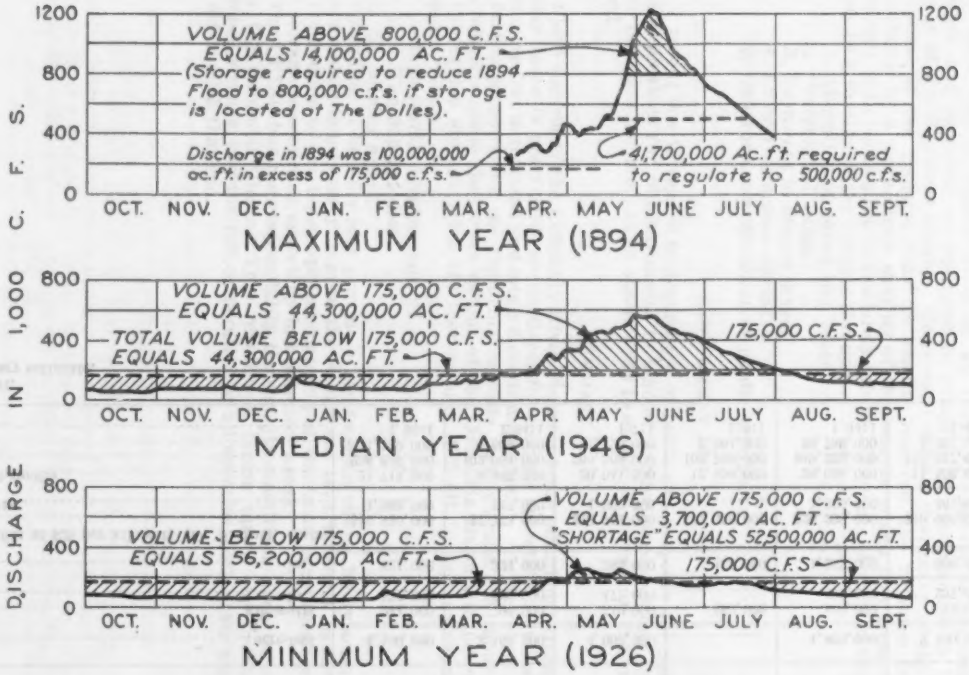

DISCHARGE IN 1,000 C. F. S.
1200
800
400
0
VOLUME ABOVE 800,000 C.F.S.
EQUALS 14,100,000 AC. FT.
(Storage required to reduce 1894 Flood to 800,000 c.f.s. if storage is located at The Dalles).
Discharge in 1894 was 100,000,000 ac.ft. in excess of 175,000 c.f.s.
41,700,000 Ac.ft. required to regulate to 500,000 c.f.s.
OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT.
MAXIMUM YEAR (1894)
VOLUME ABOVE 175,000 C.F.S.
EQUALS 44,300,000 AC. FT.
TOTAL VOLUME BELOW 175,000 C.F.S.
EQUALS 44,300,000 AC. FT.
175,000 C.F.S.
MEDIAN YEAR (1946)
VOLUME BELOW 175,000 C.F.S.
EQUALS 56,200,000 AC. FT.
VOLUME ABOVE 175,000 C.F.S.
EQUALS 3,700,000 AC. FT.
"SHORTAGE" EQUALS 52,500,000 AC. FT.
175,000 C.F.S
MINIMUM YEAR (1926)

CHART No. 1

RELATION OF STORAGE TO
FLOOD CONTROL AND REGULATED FLOW
COLUMBIA RIVER AT THE DALLES

(1)

CHART NO. 2

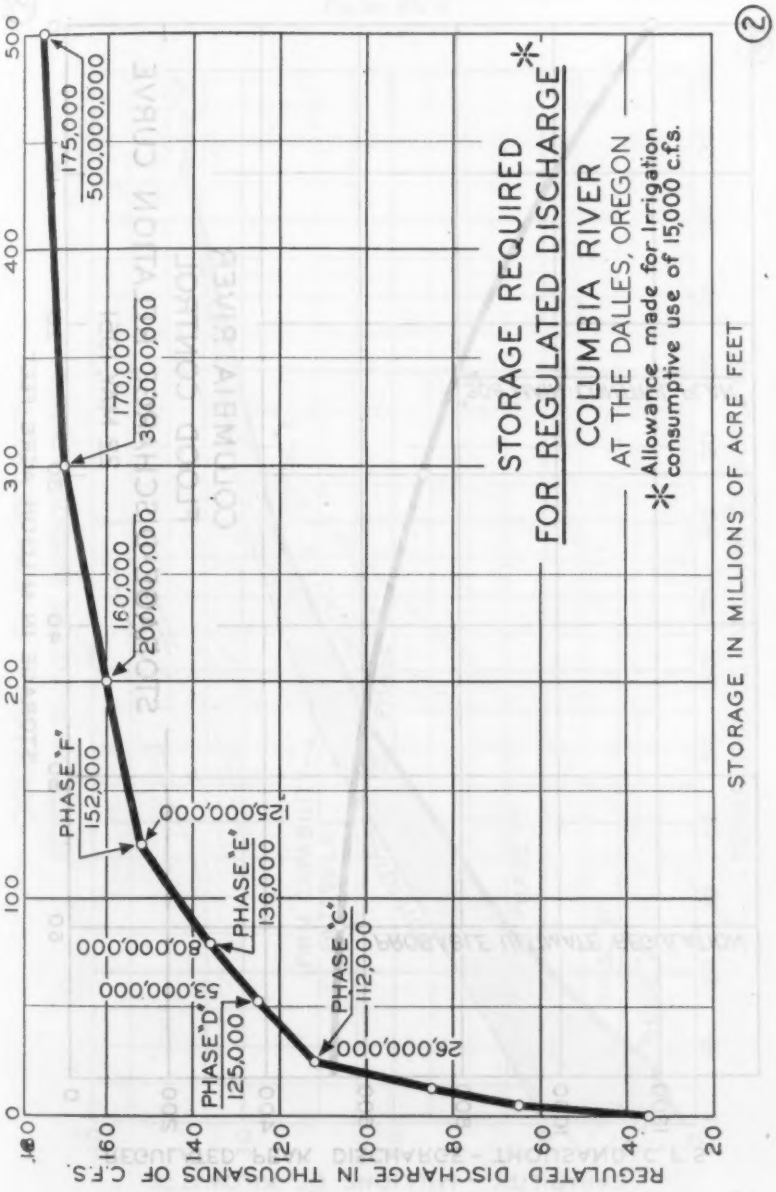

STORAGE REQUIRED
FOR REGULATED DISCHARGE *
COLUMBIA RIVER
AT THE DALLES, OREGON
* Allowance made for irrigation consumptive use of 15,000 c.f.s.
REGULATED DISCHARGE IN THOUSANDS OF C.F.S.
STORAGE IN MILLIONS OF ACRE FEET
PHASE "F" 152,000
PHASE "E" 136,000
PHASE "D" 125,000
PHASE "C" 112,000
175,000 500,000,000
170,000 300,000,000
160,000 200,000,000
125,000,000
80,000,000
53,000,000
26,000,000
0
100
200
300
400
500
20
40
60
80
100
120
140
160
180

CHART NO. 3

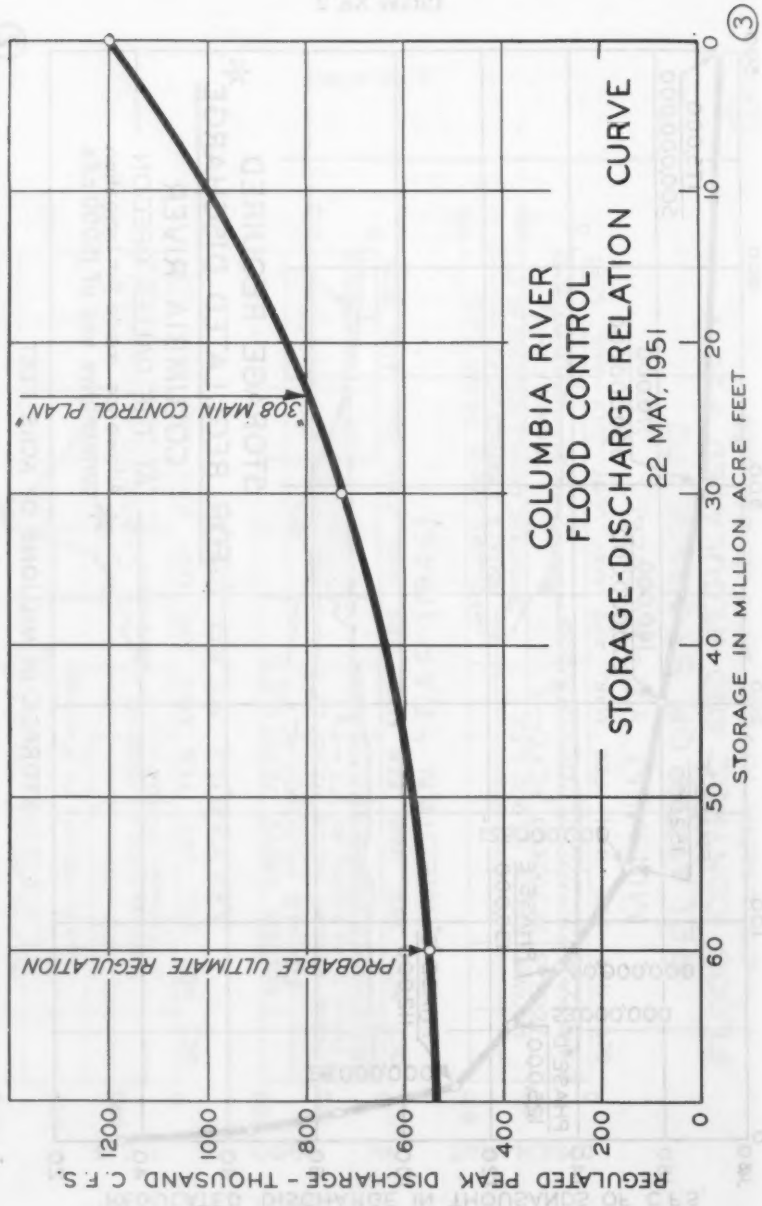
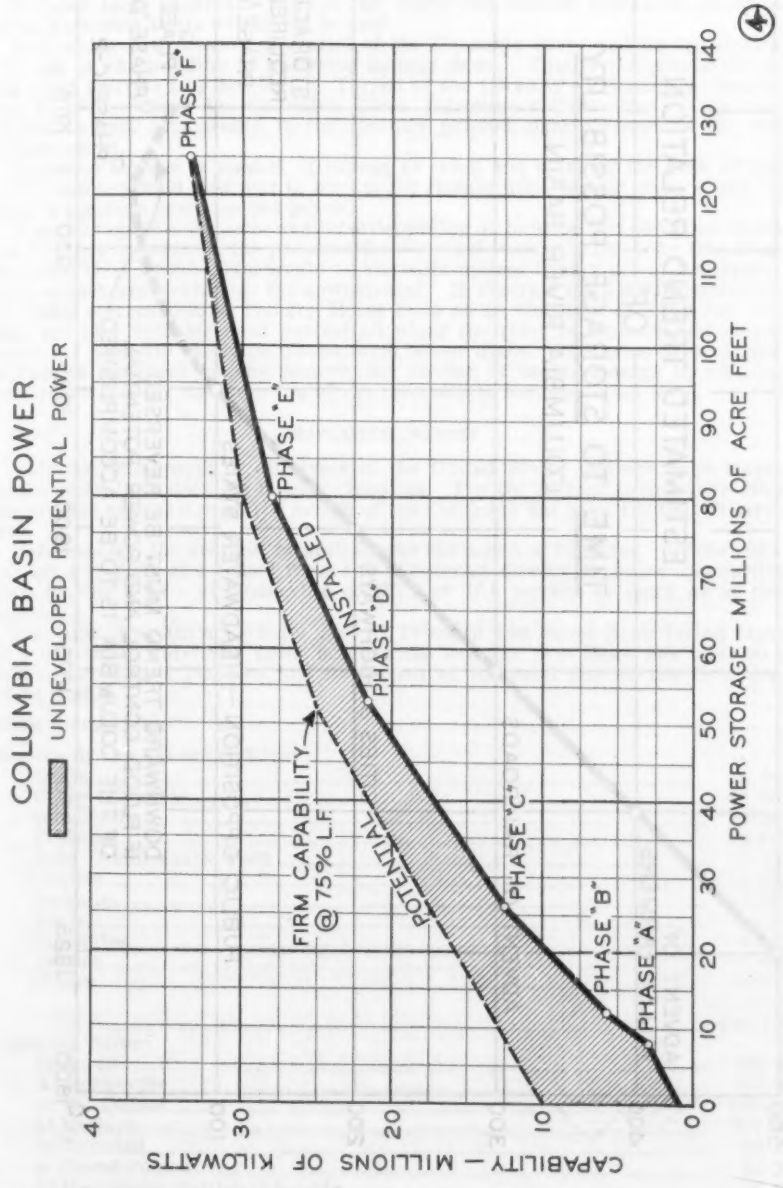

COLUMBIA RIVER
FLOOD CONTROL
STORAGE-DISCHARGE RELATION CURVE
22 MAY, 1951
"308 MAIN CONTROL PLAN"
PROBABLE ULTIMATE REGULATION
REGULATED PEAK DISCHARGE - THOUSAND C. F. S.
STORAGE IN MILLION ACRE FEET
0
200
400
600
800
1000
1200
0
10
20
30
40
50
60
(3)

CHART No. 4


COLUMBIA BASIN POWER
UNDEVELOPED POTENTIAL POWER
CAPABILITY — MILLIONS OF KILOWATTS
POWER STORAGE — MILLIONS OF ACRE FEET
0
10
20
30
40
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
PHASE "A"
PHASE "B"
PHASE "C"
PHASE "D"
PHASE "E"
PHASE "F"
INSTALLED
POTENTIAL
FIRM CAPABILITY @ 75% L.F.

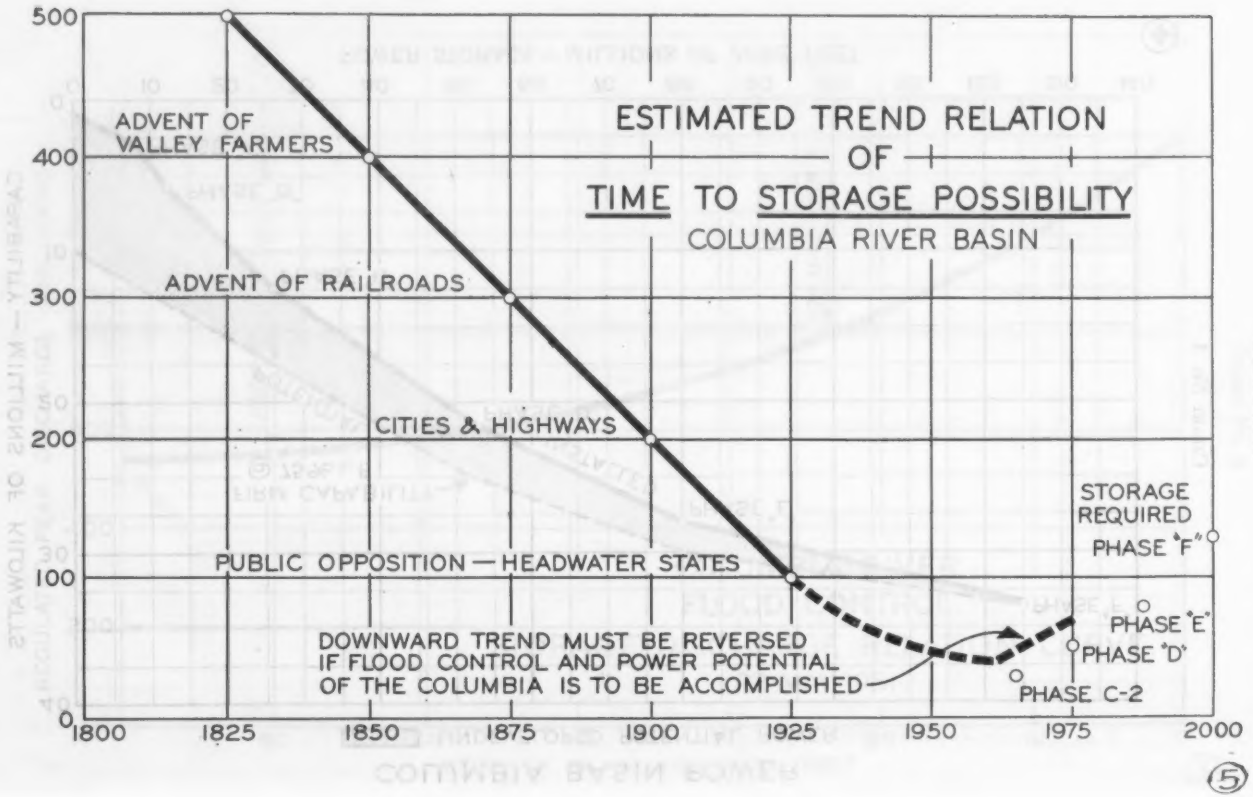

ESTIMATED TREND RELATION
OF
TIME TO STORAGE POSSIBILITY
COLUMBIA RIVER BASIN
ADVENT OF VALLEY FARMERS
ADVENT OF RAILROADS
CITIES & HIGHWAYS
PUBLIC OPPOSITION — HEADWATER STATES
DOWNWARD TREND MUST BE REVERSED IF FLOOD CONTROL AND POWER POTENTIAL OF THE COLUMBIA IS TO BE ACCOMPLISHED
STORAGE REQUIRED
PHASE "F"
PHASE "E"
PHASE "D"
PHASE C-2
500
400
300
200
100
0
1800
1825
1850
1875
1900
1925
1950
1975
2000
5

CHART No. 5

EXHIBIT B

[From Pacific Northwest Public Power Bulletin]

THE SEARCH FOR UPSTREAM STORAGE

Without large upstream storage the thirty-odd million kilowatts potential of the Columbia Basin will be cut in half.

Half of the hydroelectric potential of the Columbia River and its tributaries depends on the building of upstream storage dams. This is the conclusion of the paper delivered by Mr. Ben E. Torpen of the Corps of Engineers on December 12, 1951, before the Columbia Basin Interagency Committee. This conclusion is well documented in the recently printed eight volumes of the 308 review report.

Upstream storage is needed, of course, to catch and skim off the peak of the waste summer flood flow and to hold it for release until winter when it can be used to generate much needed power.

Some storage is much more available depending on location and elevation above sea level. For example, the proposed flood-control storage in the John Day Dam and the Priest Rapids Dam would be virtually useless from a power standpoint because they are located too far downstream. In contrast the 2,980,000 acre-feet of usable storage behind Hungry Horse Dam at an elevation of 3,560 feet not only provides valuable flood control all along the river in summer, but stores water for ultimate use in 20 downstream power dams. The value of upstream storage is measured by two factors, the volume of usable storage in millions of acre-feet and by the elevation of the reservoir in feet above sea level.

HOW MUCH WATER?

Only the Mississippi of all rivers in the United States delivers more water to the ocean than does the mighty Columbia. For the 50-year period 1897–1946 the average annual flow at the mouth of the Columbia has been 180,100,000 acre-feet.

Unfortunately the heaviest rainfall is near the mouth of the river. Of the 180.1 million acre-feet, 42.4 comes from the tributaries flowing in below Bonneville Dam leaving a flow at Bonneville of 137.7 or 76.4 percent as much as at the mouth.

The Geological Survey stream gage at Trinidad just below Rock Island Dam is a convenient reference point because the average flow there has been 90.4 million acre-feet a year, or just 50 percent of the total flow of the Columbia at its mouth.

Mean annual flow[1]

Sources of the Columbia River:	
Snake	36.82
Upper Columbia	24.60
Willamette	23.83
Kootenai	20.60
Pend Oreille-Clark Fork	18.70
Cowlitz	6.95
Spokane	5.78
Lewis	4.27
Deschutes	4.24
Yakima	4.09
Others	30.22
Total	180.10
Columbia River:	
At mouth	180.1
At Bonneville	137.7
At The Dalles	133.7
At McNary	127.6
At Trinidad	90.4
At Grand Coulee	82.5
At Revelstoke, British Columbia	24.6

[1] In millions of acre-feet based on 50-year record, 1897–1946.

Continuing above Trinidad the average flow at Grand Coulee is 82.5 which may be divided among the Kootenai, 20.6; Pend Oreille-Clark Fork, 18.7; Spokane, 5.78; the upper Columbia above Revelstoke, 24.6; and others, 12.82. The 82.5 above Grand Coulee and the 36.82 on the Snake totals 119.32 or the two-thirds of the Columbia River flow which is susceptible to upstream storage.

WHEN?

The job of leveling the flow of the river by means of upstream storage may best be visualized by examining the hydrograph of the daily mean flow at The Dalles, Oreg. At this point the mean annual flow is 133,700,000 acre-feet. If the flow were constant this rate would be 184,000 cubic feet per second as a straight line on the graph. The actual daily mean flow is a fairly straight line just under 100,000 cubic feet per second for January, February, October, November, and December. For June the flow averages 500,000 cubic feet per second with a peak in mid-June slightly over 500,000. The curve rises gradually from March 1 to June 15 and levels off at 100,000 again by October 1. It will be noted that 100,000 cubic feet per second amounts to about 6 million acre-feet in a month. The average June flow of 30 million acre-feet is thus 22.4 percent of the annual flow and is equal to the flow of the 5 low months. In half of the year the Columbia discharges 27 percent of its flow and in the other half 73 percent. But these have been mean daily figures. The curve for minimum flow is roughly half this amount while the maximum curve is about double this amount. The extreme flows of record at The Dalles have been 36,000 and 1,240,000 cubic feet per second.

HOW MANY RESERVOIRS?

The usable storage of the recently completed Hungry Horse Dam is 2,980,000 acre-feet or about 3 million. It would require 60 such reservoirs to catch and hold the entire 180.1 million acre-feet of the Columbia's mean annual flow. It would require 40 such reservoirs to hold the flow above Grand Coulee and of the Snake. But, of course, there is no need to catch the entire runoff. The need for upstream storage is only to skim off the peak summer flow.

The normal flow past the Dalles for the 6 winter months is 6 million acre-feet per month or two Hungry Horse reservoirs. The minimum daily flow curve is just half this much. That sets up the main problem: how to increase the minimum daily flow in the 6 winter months to the daily mean curve. Answer: build 6 Hungry Horse reservoirs or a total of 18 million acre-feet of usable storage.

Actually the main control plan of the 308 review report calls for 27 million acre-feet of storage to reduce an 1894 flood of 1,240,000 to 800,000 cubic feet per second at The Dalles. This plan called for 8 main control projects with usable storage as follows: Grand Coulee 5.12 million acre-feet, Heils Canyon 3.28, Glacier View 3.16, Hungry Horse 2.98, Albeni Falls 1.14, Libby 4.25, Priest Rapids 2.1, and John Day 2.0, total 24.03. In addition the report listed alternative storage sites at Kooskia 3.1, Paradise 4.08, Springston 2.595, and Nez Perce 4.8 or an added 14.575 million acre-feet.

Potential storage in Canada is 22.51 million acre-feet. Most spectacular of the Canadian projects is the Big Bend Dam with 6,900,000 acre-feet of usable storage at a pool elevation of 2,540 and a tailwater elevation of 1,920 or a dam of well over 600 feet.

All these storage sites total 61.1 million acre-feet. From a flood-control standpoint 24 million acre-feet will reduce the 1894 flood of 1,240,000 to 800,000 cubic feet per second at The Dalles while 47 million acre-feet will reduce that flood to 600,000 cubic feet per second or low enough to eliminate the need for levees along the lower Columbia.

Mr. Torpen states that the development of 33 million kilowatts in the Columbia Basin will require 125 million acre-feet of storage but from a practical standpoint only about 60 million acre-feet appears attainable. This would raise the minimum flow at The Dalles from 36,000 cubic feet per second to about 130,000 cubic feet per second and provide about 25 million kilowatts of power at 75 percent load factor.

We need all the upstream storage we can get. Every project should be built.

[From Pacific Northwest Public Power Bulletin]

MONTANA'S PARADISE DAM THREATENED

Montana's best power site will never be developed if the Montana Power Co. has its way. In that case not only Montana but the Pacific Northwest and indeed the entire Nation will be the loser.

BUFFALO RAPIDS DAM

On July 20, 1953, the Montana Power Co. applied to the Federal Power Commission for a preliminary permit to construct a 60-foot 80,000-kilowatt dam at Buffalo Rapids on the Flathead River 4 miles below Kerr Dam.

Unfortunately Buffalo Rapids is located 60 feet under the reservoir surface of the Army's proposed Paradise Dam. The Buffalo Rapids Dam would skim off the upper 60 feet of the Paradise Dam reservoir, reduce its usable storage from 4,080,000 acre-feet to 860,000, and render Paradise Dam unfeasible.

So here is another case of a private power corporation wanting to build a small dam in the bottom of a large reservoir project. The issue in the Buffalo Rapids Dam versus Paradise Dam is the same as in the battle of the Kettle Falls Dam versus Grand Coulee Dam. It is the same issue involved in the Oxbow Dam versus Hells Canyon Dam.

THE PARADISE DAM

The Corps of Engineers has made extensive studies of the Paradise Dam site. The foundations have been core drilled, the alternate sites have been studied and discarded, and considerable work has been done on preparation of plans and cost estimates.

The Army's proposed Paradise Dam would be located 2 miles downstream from Paradise, Mont., 71½ miles above Plains, Mont., and 74 miles west of Missoula. The dam would be located on the Clark Fork 4 miles below the point at which the Flathead River flows into the Clark Fork. The reservoir would be 2,700 feet above sea level which is identical with the tailwater elevation of Kerr Dam. The huge reservoir would extend up the Clark Fork 49 miles and up the Flathead River 72 miles.

The project would be in four parts with the main earthfill dam 270 feet high, 3,750 feet long with a crest height of 2,715 feet above sea level. Just downstream on the right bank will be the powerhouse with eight 72,000 kilowatt units for an initial installation of 576,000 kilowatts but with provision for 6 additional units for an ultimate installation of 1,008,000 kilowatts. The project is rated at 312,000 kilowatts of nominal prime power. Downstream from the powerhouse will be the concrete spillway and an earthfill saddle dam. Estimated cost of the project at January 1948 prices was $265,569,000 of which some $80 million would go for railroad relocation.

The ratio of benefits to costs is 1.71 to 1.0 which is quite favorable when compared with Libby 1.95, Glacier View 1.84, Kooskia 1.39, Nez Perce 1.35, Springston 1.32, Hells Canyon 1.31, The Dalles 1.25, Priest Rapids 1.22, and John Day 1.21.

The drainage basin above the dam comprises 19,900 square miles. It had a maximum record discharge of 21,300,000 acre-feet of water in 1928, a minimum of 6,400,000 in 1941 and a mean of 12,240,000. This amounts to 18,410 cubic feet per second. The maximum flood of record is 360,000 cubic feet per second, however the project is designed to reduce this to 80,000 cubic feet per second. Maximum head would be 243 feet with a full reservoir level at 2,700 feet above sea level and tailwater at 2,457 but with a 29-foot loss of head during maximum flood conditions.

CRITICAL STORAGE

The chief value of upstream dams is for the storage of summer floodwater at a high elevation for release in winter months. Paradise would have a total storage capacity of 6,520,000 acre-feet of which 2,440,000 would be dead storage and 4,080,000 live or usable storage. However, the skimming off of the upper 60 feet of the storage would cut the reservoir in half, leaving only 3,220,000 total storage, with 2,440,000 dead and only 860,000 usable storage. Thus the effective storage would be reduced by almost 80 percent if Buffalo Rapids Dam were built.

The value of upstream storage in the Pacific Northwest depends chiefly on two factors: (1) the amount of usable storage to catch spring floodwaters for

release in winter, and (2) the elevation of that storage above sea level because this is a measure of the power head through which the stored water can be put to work in the downstream generators. In this case the top of the Paradise Dam Reservoir would be 2,700 feet above sea level and have 4,080,000 acre-feet of storage. Obviously an acre-foot of water at this level is worth more than twice as much from a power standpoint as an acre-foot in the Grand Coulee Reservoir at an elevation of only 1,290.

By comparison Libby Dam would have an active storage of 4,250,000 acre-feet at a full reservoir level of 2,440 feet above sea level. Hells Canyon would have 3,880,000 acre-feet at 2,077 feet. Hungry Horse Dam has 2,980,000 at 3,560 feet.

Another factor to consider in evaluating an upstream reservoir is the mean annual runoff. Thus at Hungry Horse Dam the streamflow varies from 206 to 46,000 cubic feet per second, or a mean of 3,323 cubic feet per second. The mean annual runoff is 2,136,000 acre-feet, or less than enough each year to refill the active storage capacity of 2,980,000. Thus Hungry Horse has a ratio of mean annual runoff to active storage of less than one. Yet it is a good project. Hells Canyon, with a mean annual runoff of 12,059,000 acre-feet has a ratio of better than 3. Libby, with a mean annual runoff of 7,910,000, has a ratio of about 2. And Paradise Dam, with a mean annual runoff of 12,240,000 acre-feet, has a ratio of better than 3.

MONTANA'S BEST DAM

Montana has remaining 88 potential hydroelectric sites with a projected nameplate capacity of 5,372,980 kilowatts. The dry eastern portion of the State has 61 sites capable of 1,337,200 kilowatts, while the steep western slopes offer 27 sites capable of 4,035,780 kilowatts. However, of this total, the Paradise Dam alone accounts for 1,008,000 kilowatts. It is 18.7 percent of the total for the State.

DRY SPILLWAY

Not only does Montana have a great stake in the Paradise Dam: the entire Pacific Northwest should be just as concerned as it is over Hells Canyon. The principles and issues are the same. Half the power potential of this region hangs on upstream storage. Without the Paradise Dam, Glacier View, Hells Canyon, Nez Perce, and other upstream storage reservoirs, the 34 million kilowatt potential of the Northwest is cut in half.

The dream of the hydroelectric engineer is to build a series of dams where all the water runs through the generators and none over the spillway. This is the dream of controlling the river. This is one of the aims of comprehensive planning. Upstream storage dams are the means for leveling the river flows so that an ever greater portion of the water can be put through the generators to work for man.

THE 308 REPORT

The Paradise Dam is an essential part of the Corps of Engineers 308 review report for comprehensive development of the Columbia River and its tributaries, also known as House Document No. 531. In volume I see pages 154–156, artist's sketch of Paradise Dam on page 136 and plates 25, 31, 32, and 33. In volume II see pages 615–626, pages 708–729, and plates 2, 11, 12, 46–58.

[From Pacific Northwest Public Power Bulletin]

THE SNAKE RIVER: AMERICA'S FINEST POWER STREAM!

One-eighth of America's hydroelectric power potential runs unharnessed in the deep canyons of the turbulent Snake River. If the 11,193,340 kilowatts of the Snake River were developed, it would more than triple the electric supply of the Pacific Northwest. And it would open up a vast new country.

People all over the Nation are beginning to hear about this river because of the Hells Canyon battle. In connection with that controversy the Corps of Engineers is making new surveys of eight power sites in the middle Snake River Basin.

The Walla Walla office of the corps on August 24, 1953, stated it had received $140,000 with which to prepare by January 1, 1954, a report on the Nez Perce Dam and Mountain Sheep Dam on the Snake River, Crevice Dam on the Salmon River, Forks, Kooskia, and Penny Cliffs Dams on the middle fork of the Clearwater River, and Elkberry and Bruces Eddy Dams on the north fork of the

Clearwater. The study was requested by Senator Henry Dworshak, of Idaho, who has consistently opposed the Hells Canyon Dam.

MEASURING THE RIVER

The water powers of the Nation total 107 million kilowatts according to the Federal Power Commission, but as of January 1952 only 19,900,000 kilowatts or 18.6 percent had been developed; in fact 1,200,000 kilowatts had been developed during 1951. That left 87,100,000 kilowatts or 81.4 percent still running wastefully to the sea. Of this national total 34,728,670 kilowatts or 40 percent is in the Pacific Northwest divided 1,457,670 kilowatts on Oregon coastal streams, 2,242,300 kilowatts on Washington coastal and Puget Sound streams and 31,028,700 kilowatts in the Columbia River Basin. The 11,193,340 kilowatts potential of the Snake is thus 12.84 percent or one-eighth of the national total and 36.1 percent of the Columbia Basin total.

The energy left in the Snake is equivalent to that of 21 Bonneville Dams. Its usable upstream storage is equal to 11 Hungry Horse Dams. Almost half of the region's future upstream storage is in the Snake River Basin.

The Snake is a steep river dropping from 9,400 feet in Yellowstone National Park to 300 feet at its mouth near Pasco in a length of 1,073 miles. In contrast the Columbia in its 1,207-mile flow from Columbia Lake in Canada to the Pacific drops only 2,652 feet.

From Weiser at elevatiton 2,080 the Army plans to harness every foot of drop to McNary Reservoir at 340-foot elevation. This is the canyon area where at many points the Hells Canyon is deeper and wider than the Grand Canyon of the Colorado. This is also where the two great tributaries join the Snake. Of the 109,000 square miles of drainage area in the Snake Basin the Clearwater River involves only 9,600 square miles and the Salmon 14,100 square miles, yet they provide most of the water. During the past 50 years the 36.82 million acre-feet average flow of the Snake has come from the Clearwater 11.3, Salmon 8.1, upper Snake 13.5, and other tributaries, 3.92. The Salmon and the Clearwater have many excellent power sites but they also have salmon runs.

This is a phenomenal river, yet in 1948 the Army could list only 171,300 kilowatts of harnessed hydro for the entire basin or 1½ percent of the potential. Even today the river is 97 percent undeveloped. It is practically a virgin river.

The Snake River Basin shown as a major portion of the Columbia River Basin

Basis of comparison	Columbia	Snake	Ratio
			Percent
Undeveloped power, kilowatts	31,028,700	11,193,340	36.1
Undeveloped energy, 1,000 kilowatt-hours	143,644,008	49,886,300	35.0
Future usable storage, acre-feet	71,781,690	33,349,325	46.5
Drainage area, square miles	259,000	109,000	42.0
Length, miles	1,207	1,073	
Altitude at source, feet	2,652	9,400	
Average annual flow, acre-feet (flow at the Columbia mouth)	180,100,000	36,820,000	20.4
Average annual flow, acre-feet (flow at The Dalles)	133,700,000	36,820,000	27.5
Maximum flood, 1894, cubic feet per second	1,240,000	409,000	33.0

Snake River power potentialities

Dam (number of sites)	Power in kilowatts [1]	Energy, million kilowatt-hours	Head, feet	Usable storage, acre-feet
Lower and Middle Snake:				
Ice Harbor	325,000	2,000	100	None
Lower Monumental	300,000	1,850	93	None
Little Goose	325,000	2,015	100	None
Lower Granite	275,000	1,630	82	None
Clarkston	180,000	710	46	None
Asotin	400,000	2,146	140	None
Nez Perce	1,980,000	7,393	615	4,800,000
Hells Canyon	900,000	4,051	602	3,880,000
Lower tributaries (14)	461,340	2,138		1,927,800
Clearwater River:				
Kooskia	550,000	1,568	514	3,100,000
Elkberry	420,000	1,603	523	1,390,000
Rock Creek	364,000	1,419	600	593,000
Bruces Eddy	270,000	1,200	367	510,000
Moose Creek	240,000	718	592	830,000
Minor sites (18)	1,047,500	4,285		1,420,000
Salmon River:				
Crevice	500,000	2,243	511	1,030,000
Freedom	260,000	1,069	222	180,000
Growler Rapids	248,000	968	305	300,000
Pinnacle Peak	243,000	944	376	445,000
Black Canyon	238,000	927	332	425,000
Minor sites (55)	688,500	3,886		4,190,800
Upper Snake (50)	978,000	5,123		8,327,725
Total, 155 sites	11,193,340	49,886		33,349,325
18 major sites	8,018,000	34,454		17,483,000
137 minor sites	3,175,340	15,432		15,866,325

[1] Power does not include downstream benefits.

CONTROLLING THE RIVER

The Snake River is susceptible to complete control by means of dams and upstream reservoirs which for the most part will flood only desolate uninhabitable canyons. The harnessability of the stream is indicated in the table which shows 18 sites with 8,018,000 kilowatts potential. The next 24 sites, all over 50,000 kilowatts, provide 2,104,000 kilowatts, leaving 103 sites for the remaining 1,071,340 kilowatts. Most of the power is concentrated conveniently in large blocks.

Equally impressive is the upstream storage picture. After allowing for maximum possible depletions for irrigation, the Army computed that 26,023,900 acre-feet of upstream storage would completely control the river by leveling the flow at 36,637 cubic feet per second. In fact, the 33,349,325 acre-feet of potential storage can make the peak flow of the Snake coincide with the winter electric peak loads of the Pacific Northwest.

THE PROMISE OF THE SNAKE

Locked in the canyons of the Snake River is one-eighth of the Nation's future hydropower and one-third of the hydro of the Northwest. The Snake is almost a virgin stream, 97 percent undeveloped. It offers 33 million acre-feet of urgently needed upstream storage. The Snake River is the finest power stream in America. Keep an eye on the Snake because this power belongs to the people, all the people of the Nation.

[From Pacific Northwest Public Power Bulletin]

THE ARMY SPEAKS FOR HELLS CANYON

The Hells Canyon Dam would probably be under construction today by the Federal Government if it had been permitted to remain an Army project. For that matter it could still be built by the Army.

THE FACTS OF RECENT HISTORY

The Corps of Engineers issued its Interim Report No. 3 entitled "Hells Canyon Dam" December 22, 1947. The timing, however, was not for purposes of making the project a Christmas present to the Bureau of Reclamation, which even then was plotting for potential support to make Hells Canyon a Bureau project. Both agencies spent considerable sums on site investigations, the Bureau site being 3 miles downstream from the Army site. Four months later in April 1948 the Bureau issued its 120-page report Hells Canyon Project.

Then on October 1, 1948, the corps unveiled its monumental 308 Review Report. In regard to Hells Canyon it, of course, overlapped parts of the Bureau's hastily prepared report, "The Columbia River," dated February 8, 1947. The Bureau's report for the first time proposed the controversial Columbia Basin account for subsidization of uneconomical irrigation projects from interest paid at Army dams.

Meanwhile President Truman in letters on June 1 and September 16, 1948, told the agencies to get together. The resultant shotgun wedding or Weaver-Newell agreement of April 11, 1949, gave Hells Canyon to the Bureau. It should be recalled that this shotgun or atomic wedding was caused by supposed threats of (1) CVA which would put both agencies out of the Pacific Northwest power business, and (2) the Hoover Commission report which urged transferring Army civil functions to the Interior Department.

The issue came before Congress in the debate on the proposed amendment to H. R. 5472, the River and Harbor Act of 1950, which aimed at authorization of the Columbia Basin account and of Bureau construction of Hells Canyon. The basin account was clearly in the process of being defeated when Senator Chavez, chairman of the Senate Public Works Committee, on April 14, 1950, on page 5253 of the Congressional Record offered to include Hells Canyon in the bill as an Army dam. He was turned down. It was all or nothing. The Bureau insisted on both the Columbia Basin account and on its being authorized to build Hells Canyon.

It will be noted that the Rivers and Harbors Act of 1950 authorized the Priest Rapids Dam, Libby, Albeni Falls, The Dalles, and John Day Dam. These 5 projects constitute phase C of the 308 review report except for Hells Canyon which was originally part of phase C until transferred to the Bureau.

Why was the Bureau so desperately determined to build Hells Canyon and why did it seize advantage of the 1948 political situation and of the Hoover report to wrest the project from the corps? Firstly, the Bureau with its huge staff was running out of work. Secondly, it had invented a fiction called the Snake River project whereby Hells Canyon power sales would help pay for the costly Mountain Home irrigation project although the latter is located 200 miles upstream from Hells Canyon. Thirdly, it gambled on the merits of Hells Canyon to carry the Columbia Basin account as a rider. Originally the Bureau also intended to build the transmission lines from Hells Canyon but was overruled by Secretary Krug who designated BPA. Throughout this history the Bureau has shown a tendency to favor single-purpose development for irrigation even at the expense of other water uses.

THE ARMY RECORD

The Army chose not to fight back. However, the record and the attitude of the Corps of Engineers toward Hells Canyon Dam is written where all can read in the 308 review report. Over 125 pages of engineering facts, tables, charts, and plates point out the merits of the project.

Division Engineer Col. Theron D. Weaver recommends on page 342, "The following multipurpose dams and reservoirs are recommended for immediate construction in the interest of flood control, navigation, power, and other water uses: Libby, Albeni Falls, Priest Rapids, Hells Canyon, John Day, The Dalles, and in addition Glacier View or an alternate."

The Army Board of Engineers on February 21, 1949, endorsed the comprehensive plan including Hells Canyon. Four months later and after the transfer of April 11, 1949, Chief of Engineers, Maj. Gen. Lewis A. Pick, endorsed the 308 review report and recommended, "That authority be provided to the Bureau of Reclamation for modification of Grand Coulee and Hungry Horse Dams and for the construction of Hells Canyon Dam. * * *"

In addressing the convention of the Northwest Public Power Association at Port Angeles August 12, 1948, division engineer, Col. Theron D. Weaver, stated, "One of the planned projects providing flood control is Hells Canyon Dam and

Reservoir on the Snake River, which would contribute to the reduction of downstream floods from Lewiston to the highly developed lower Columbia area * * * The flood-control benefits coupled with the great power potential of Hells Canyon, make it one of the key projects in the basin plan as contemplated in the Columbia River Report."

ALL IS NOT LOST

The Hells Canyon project is strongly endorsed throughout the 308 report and in the addresses and testimony of corps officials, especially in the addresses of Mr. Ben Torpen on upstream storage and in the testimony of Mr. Gordon Fernald on March 31, 1952, at the Hells Canyon hearings by the House Subcommittee on Irrigation and Reclamation.

Truth does not always prevail over might, in this case the might of propaganda and lobbying and political intrigue, but usually truth, given time, will win. It should in the Hells Canyon issue.

It is not truthful, in fact it is subterfuge, to say Hells Canyon is an irrigation project. It is truthful to say that jurisdiction over flood control, navigation, and power projects such as Hells Canyon traditionally and by law resides in the Corps of Engineers. To defy these deeply entrenched lines of jurisdiction is not wise as has been amply demonstrated the past 5 years.

The Northwest Public Power Association resolution urges Hells Canyon construction by either agency.

THE 308 REPORT

Hells Canyon Dam is an essential part of the 308 Review Report for comprehensive development of the Columbia River and its tributaries. It is extensively discussed in some 125 pages of the report. Its immediate construction is specifically and strongly recommended by the division engineer, the Board of Engineers, and the Chief of Engineers, and supported by justifying language in volume I. In volume IV in appendix I entitled "The Middle and Lower Snake River Basin" is presented the detailed engineering and cost data. Volume VIII in appendix O devotes some 58 pages on power characteristics of the project and its relationship to regional loads. Mention is made in appendixes M, P, and R. Added data can be found in interim report No. 3 issued by the corps December 22, 1947, entitled, "Hells Canyon Dam."

EXHIBIT C

FEDERAL POWER COMMISSION,
Washington, March 13, 1952.

Mr. GUS NORWOOD.
Executive Secretary, Northwest Public Power Association, Inc.,
Vancouver, Wash.

DEAR MR. NORWOOD: This is in further reply to your letter of February 18 requesting a tabulation of potential waterpower sites for the Pacific Northwest and the power available from each of them.

As promised in my acknowledgment of February 28, we are forwarding by enclosure a tabulation of undeveloped waterpower sites in river basins draining into the Pacific Ocean between California and Canada. The tabulation is a compilation of data based on studies and reports of Federal, State, and local agencies, utilities, and other interests. The tabulation shows the estimated installed generating capacity and average annual generation for each project, together with the estimated gross head, drainage area (where obtainable) and storage capacity available for power use. The compilation includes projects at sites where physical conditions indicate engineering feasibility and promise of economic feasibility some time in the future. In cases where sites are on interstate boundary sections of rivers the available power has been, in general, divided equally between adjoining States.

The Commission's estimates are based on the rated capacity of generators that would normally be installed at potential hydroelectric developments assuming reasonable regulation of flow by storage, depletion by irrigation and other consumptive use, and other factors pertinent to the best overall development of the river for power and other uses. The energy estimates represent average annual production by the estimated installed capacity.

These estimates must be revised from time to time as new studies are made and additional information is obtained. It is emphasized that the estimates have been based in many cases upon preliminary investigations and, therefore, that much additional detailed study is required before a selection of projects can be made in formulating any comprehensive plan of river development. Although some of these potential projects may, upon detailed investigation, be found infeasible and impracticable of development from physical, economic, or other reasons, the projects taken in the aggregate serve to indicate, from a long-range view, the overall waterpower potentialities of the river basins and the waterpower resources available for possible future development.

It is hoped that this tabulation will adequately provide you with the information you desire.

Sincerely yours,

THOMAS C. BUCHANAN, *Chairman.*

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada

River basin, project, or site	Stream	Code Nos. River	Code Nos. Site	Code Nos. State	Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
NORTH PACIFIC DRAINAGE		900000							
		904000							
NOOKSACK									
Nooksack Falls	Nooksack River	904000	10	46	33,000	205,000	750	66	220,000
Skookum Creek	do	904000	20	46	20,300	158,600	560		16,000
Edfro Reservoir	South Fork Nooksack River	904000	30	[1] 46				102	450,000
Total					53,300	363,600	1,310		686,000
		905100							
WHATCOM CREEK									
Whatcom Creek 2	Whatcom Creek	905100	10	46	2,400	19,200	40		
Whatcom Creek 1	do	905100	20	46	14,400	115,200	250		
Total					16,800	134,400	290		
		906000							
SKAGIT									
Lyman	Skagit River	906100	05	46	65,000	371,400	770		
The Dalles	do	906100	10	46	42,000	277,200	31	2,700	
Baker River	Baker River	906100	15	46	28,800	186,000	259	270	
Upper Baker	do	906100	20	46	50,600	301,300	299	184	116,000
Lower Sauk	Sauk River	906200	10	46	70,000	430,100	218	714	542,000
Upper Sauk	Dan Creek	906200	15	46	45,000	350,400	605	238	
Upper Sauk Reservoir	Sauk River	906200	17	[1] 46				238	88,000
North Fork Sauk	North Fork Sauk River	906200	20	46	29,000	212,000	845	78	34,000
Sloan Creek	do	906200	25	46	9,500	67,000	400	52	
Sloan Reservoir	Sloan Creek	906200	27	[1] 46				52	28,000
Lower Whitechuck	Whitechuck River	906200	30	46	14,700	104,200	795	50	
Upper Whitechuck	do	906200	40	46	14,300	100,700	1,200	30	
Lower Sulattle	Sulattle River	906200	50	46	31,000	241,800	505	255	
Buck Creek 1A	Buck Creek	906200	60	46	12,000	76,600	1,200	21	
Buck Creek 1	Sulattle River	906200	70	46	19,900	153,300	380	182	
Downey Creek 1	do	906200	80	46	12,200	92,800	385	107	
Downey Creek 1A	Sulphur Creek	906200	85	46	24,100	156,800	1,115	46	
Upper Sulattle	Sulattle River	906200	90	46	18,400	140,200	625	98	
Illabot Creek	Illabot Creek	906300	10	46	13,500	96,400	1,000	32	
Cascade	Cascade River	906400	10	46	50,000	320,000	610	148	104,000
County Line	Skagit River	906500	20	46	90,000	414,300	115	1,190	40,000
Gorge	do	906500	30	[2] 46	70,000	528,100	385	1,140	6,000
Diablo	do	906500	40	[2] 46		168,200	330	1,102	
Thunder Creek	Thunder Creek	906600	10	46	13,000	98,000	640	90	
Ross	Skagit River	906700	10	46	360,000	847,000	395		

Ross	Skagit River	906700	10	46	360,000	847,000	395	978	3,000,000
Total					1,083,000	5,733,800	13,077		3,958,000
STILAQUAMISH		908000							
Jorden	South Fork Stilaquamish River	908000	10	46	6,800	55,200	117		51,000
Granite Falls	do	908000	20	46	17,500	136,400	255	159	
Robe	do	908000	30	46	30,000	246,600	480	140	58,500
Tyree	do	908000	40	46	15,000	99,500	290	101	40,000
Oso	North Fork Stilaquamish River	908000	50	46	15,750	108,000	136	300	180,000
Deer Creek	do	908000	60	46	50,000	179,700	486	75	
Lake Cavanaugh	Lake Creek	908000	70	[1] 46				75	100,000
Total					135,050	825,400	2,164		429,500
SNOHOMISH		910000							
Sultan	Sultan River	910200	10	46	69,000	344,700	852	69	184,300
Wallace Lake	East Fork, Wallace	910200	25	46	22,000	177,800	1,255	18	
Sunset Falls	Skykomish River	910200	30	46	84,500	591,000	520	355	
Miller Forks	Miller Creek	910200	40	46	4,500	32,400	310		
East Fork, Miller	East Fork Miller Creek	910200	50	46	4,900	38,400	770		
Lower Dorothy	do	910200	55	46	3,500	30,600	1,070		32,000
Upper South Forks	Skykomish River	910200	60	46	8,100	57,000	120	232	
Tonga	Foss River	910200	65	46	7,600	56,600	495		
Alturas Lake	East Fork Foss River	910200	70	46	5,000	37,800	440		8,800
Beckler	Beckler River	910200	75	46	13,700	93,200	535		
Trout Creek	Trout Creek	910200	80	46	2,300	15,100	850	15	
Giddings Creek	North Fork Skykomish River	910200	85	46	13,500	94,100	450		
Troublesome 2	Troublesome Creek	910200	90	46	3,100	23,600	750		
Troublesome 1	do	910200	95	46	3,600	31,300	2,130		
Upper Falls	South Fork Snoqualm River	910400	10	46	8,500	58,000	500		14,500
Mount Si	Middle Fork Snoqualm River	910400	20	46	46,800	315,400	511	158	115,000
Lower North Fork	North Fork Snoqualm River	910400	30	46	34,000	197,100	525	100	
Calligan Creek	do	910400	40	46	22,300	106,000	465	52	163,000
Snoqualmie Falls	Snoqualmie River	910,400	50	46	35,100	217,200	270	375	
Total					383,000	2,517,300	12,818		517,600
PUYALLUP		912000							
Mud Mountain	White River	912200	10	46	40,000	220,000	615	320	20,000
Twin Creek	do	912200	20	46	15,000	95,000	530		20,000
West Fork mouth	West Fork White	912200	40	46	4,800	34,200	560	48	
Huckleberry	White River	912200	60	46	3,450	24,700	195	101	
East Fork Rainier	East Fork White River	912200	70	46	4,900	35,000	360	78	
Carbon 3	Carbon River	912300	20	46	9,000	60,000	480	89	
Carbon 2	do	912300	30	46	9,000	60,000	470	79	
Carbon 1	do	912300	40	46	10,100	74,500	705	52	
Orting	Puyallup River	912300	50	46	14,000	120,000	442	125	
Mowich 1A	do	912300	60	46	4,500	33,300	575	23	
Mowich 1	Mowich River	912300	70	46	7,200	53,400	815	26	
Total					121,950	810,100	5,747		40,000

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos. River	Code Nos. Site	Code Nos. State	Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
NORTH PACIFIC DRAINAGE—Continued									
NISQUALLY		914000							
Centralia	Nisqually River	914000	10	46	11,000	87,600	208	535	
Tributary Nisqually	do	914000	20	46	6,800	55,700	87	301	
Park Junction 2	do	914000	30	46	3,900	28,400	115	139	
Park Junction 1	do	914000	40	46	9,600	71,800	550	73	
Total					31,300	243,500	960		
HOOD CANAL		918000							
Tunnel Creek	Quilcene River	918100	20	46	5,800	40,700	944		
Chandler	Dosewallips River	918200	10	46	5,500	40,500	170	109	
Nameless	do	918200	20	46	6,100	43,400	330		
Jump Off	do	918200	30	46	15,000	78,800	620	80	3,500
Interrorem	Duckabush River	918400	10	46	5,900	44,400	360		15,000
Cliff Creek	do	918400	20	46	6,600	45,620	400		
HighCliffs	do	918400	30	46	7,850	54,250	572		
Hamma 1	Hamma Hamma River	918600	10	46	12,000	89,300	504		15,800
Staircase	Skokomish River	918800	10	46	5,200	35,200	275		
Seven Stream	do	918800	20	46	6,000	41,000	490		
Total					75,950	513,170	4,605		34,300
DUNGENESS		920000							
12 PM 24	Dungeness River	920000	10	46	2,600	13,100	160		
12 PM 23	do	920000	20	46	5,800	29,100	334		
Forks	do	920000	30	46	5,000	36,600	294		
Grey Wolf	Grey Wolf River	920000	40	46	3,650	27,000	512		
Gold Creek	Dungeness River	920000	50	46	2,800	20,500	358		
Upper Dungeness	do	920000	60	46	4,550	33,600	954		
Total					24,400	159,900	2,612		
ELWAHA		921200							
Tailwater	Elwaha River	921200	10	46	7,250	56,600	82	314	
McDonald	do	921200	20	46	17,050	136,000	225	244	
Geyser Basin	do	921200	30	46	9,950	79,800	190	196	26,000
Windfall Creek	do	921200	40	46	11,400	91,200	290	119	
Little Lost	do	921200	50	40	10,500	84,200	290	110	
Press Valley	do	921200	60	46	5,700	46,800	220	98	46,000

Little Lost	do	921200	50	46	5,700	46,800	220	98	46,000
Press Valley	do	921200	60	46	2,400	17,400	230	41	
Godman Creek	do	921200	70	46	1,500	10,700	282	20	
Delabarre Creek	do	921200	80	46					
Total					65,750	522,700	1,809		72,000
LYRE		921300							
Lower Lyre	Lyre River	921300	10	46	11,900	100,300	290		
Lower Crescent	do	921300	20	46	12,500	105,400	297		72,000
Total					24,400	205,700	587		72,000
SOLEDUCK		921800							
Fairholm	Soleduck River	921800	10	46	17,700	119,000	481	79	
HOH		922000							
Log Jam	Hoh River	922000	10	46	22,000	191,500	150	288	
Oxbow	do	922000	20	46	24,000	211,500	170	233	243,000
Rends	South Fork Hoh River	922000	30	46	5,250	38,850	240	45	
Fords	do	922000	40	46	2,950	21,760	125	42	
Slate Creek	do	922000	50	46	13,550	100,100	1,300	18	
Spruce Creek	Hoh River	922000	55	46	4,600	34,000	70	175	
Twin Creek	do	922000	60	46	8,200	60,800	200	90	
Mineral Creek	do	922000	70	46	4,550	33,850	150	60	
Glide Creek	do	922000	80	46	8,500	62,900	380	35	
Total					93,600	755,260	2,785		243,000
QUEETS		923000							
Lower Queets	Queets River	923000	10	46	17,000	74,500	68		35,000
Upper Queets	do	923000	20	46	10,000	43,800	803		
Total					27,000	118,300	871		35,000
QUINAULT		924000							
Quinault Lake	Quinault River	924000	10	46	13,850	99,500	95		
South Fork	do	924000	20	46	15,350	104,000	190		
Rustler River	do	924000	30	46	13,100	88,900	300		
Total					42,300	292,400	585		
CHEHALIS		926000							
Lower Canyon	Wynoochee River	926000	10	46	9,100	76,400	164		74,800
Save Creek	do	926000	20	46	5,700	47,300	152	74	
Weatherwax	do	926000	30	46	12,000	100,000	284	66	228,000
Total					26,800	223,700	600		302,800
NORTH		927000							
North River	North River	927000	10	46	20,000	87,600	112		125,000

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN		930000							
COWLITZ		930140							
Castle Rock	Cowlitz River	930140	05	46	260,000	1,000,000	200	2,240	
Kid Valley	Toutle River	930140	10	46	94,000	350,000	475	275	625,000
Upper Green	Green River	930140	15	46	5,000	21,900	250		96,000
Elk Creek	Toutle River	930140	25	46	10,000	72,700	500	80	
Coldwater Creek	do	930140	30	46	8,250	61,000	600	51	
Spirit Lake	do	930140	35	46	4,800	41,600	1,124	13	34,000
Mayfield	Cowlitz River	930140	40	46	180,000	657,000	185	1,400	
Tilton	Tilton River	930140	43	46	33,000	128,000	385	150	110,000
Mossyrock	Cowlitz River	930140	45	46	255,000	1,070,000	345	1,160	1,100,000
Cowlitz Falls	do	930140	50	46	210,000	797,000	330	1,000	3,254,000
Greenhorn Creek	Cispus River	930140	55	46	47,000	190,000	285	351	285,000
Muddy Fork	do	930140	65	46	80,000	287,300	1,450	92	96,000
Walupt Lake	do	930140	70	46	8,000	30,700	800	20	40,000
Packwood Lake	Lake Creek	930140	75	46	20,000	90,000	887	18	41,000
Silver Falls	Ohanapecosh River	930140	80	46	23,200	184,400	930	95	35,000
Total					1,238,250	4,981,600	8,546		5,716,000
LEWIS		930180							
Merwin	Lewis River	930180	10	[1] 46	90,000		185	731	
Yale	do	930180	20	46	200,000	550,000	255	608	90,000
Swift Creek	Swift Creek	930180	35	46	7,000	48,300	810	26	
Devils Bone	Lewis River	930180	38	46	84,000	365,000	310	457	230,000
Pine Creek	Pine Creek	930180	40	46	2,700	18,300	470	16	
Eagle Cliff	Lewis River	930180	45	46	50,000	227,000	220	375	100,000
Clearwater Creek	Muddy River	930180	50	46	6,500	49,400	330	72	16,000
Paradise Falls	Clearwater Creek	930180	55	46	17,000	67,500	920	20	90,000
Clear Creek	Clear Creek	930180	60	46	5,800	39,000	750	31	
Rush Creek	Rush Creek	930180	65	46	4,350	30,000	1,250	14	
Big Meadow	Big Creek	930180	70	46	14,350	126,000	2,110	24	108,000
Cascade Gorge	Lewis River	930180	75	46	22,000	99,000	285	146	53,000
Quartz Creek	do	930180	80	46	12,700	92,300	415	124	168,000
Steamboat Creek	do	930180	90	46	9,500	73,500	550	66	68,000
Total					525,900	1,785,300	8,860		923,000
WILLAMETTE		930200							
Clear Creek	Clackamas River	930220	10	36	16,000	72,900	40	844	
Lower Clackamas	do	930220	20	36	72,000	331,000	180	842	
River Mill	do	930220	22	[2] 36	4,150	46,000	82	677	

River Mill	do	930220	22	[3] 36	4,150	46,000	82	677		
Cazadero	do	930220	24	[3] 36		29,000	133	665		
Cliff	do	930220	26	36	108,000	510,700	480	625	125,000	
Oak Grove	do	930220	30	[3] 36	25,500	20,000	925	131		
Nowhere Meadow	Clackamas River	930220	40	36	28,000	177,800	240	466	80,000	
Timothy Meadow	Oak Grove Fork	930220	60	36	30,000	167,300	1,210	82	130,000	
Big Bottom	Clackamas River	930220	65	36	20,000	83,200	340	132	250,000	
Scotts Mills	Butte Creek	930230	10	36	3,100	19,500	650			
Camp Creek	Abiqua Creek	930230	20	36	3,600	22,600	500			
Headwaters	do	930230	30	36	2,400	15,100	800			
Silverton	Silver Creek	930230	40	36	3,800	24,100	800			
Pelkey	Molalla River	930230	80	36	4,700	34,600	260	90	30,000	
Headwaters	do	930230	90	36	5,300	33,400	475	55		
Albany sites	South Santiam River	930240	10	36	11,000	89,600	175			
Waterloo Division	do	930240	15	36	3,800	30,000	65	690		
McDowell Creek	do	930240	20	36	2,700	22,000	50			
Foster Division	do	930240	25	36	7,600	61,800	100	565		
White Bridge	Middle Santiam River	930240	35	36	15,000	66,000	93	283	1,850	
Green Peter	do	930240	38	36	81,000	212,000	321	283	322,000	
Bear Creek	do	930240	40	36	11,700	73,600	800	81		
Roberts Division	Quartzville Creek	930240	44	36	3,700	23,300	200	104		
Packers Gulch	do	930240	46	36	8,600	54,200	600	78		
Junction Division	South Santiam River	930240	48	36	3,100	23,200	126	179		
Cascadia	do	930240	50	36	15,000	70,000	258	179	165,000	
Patterson	do	930240	54	36	2,900	22,800	164	77	56,000	
Mehama Division	North Santiam River	930240	65	36	40,000	208,500	207	525		
Mill City	do	930240	70	36	42,000	207,000	219	468		
Big Cliff	do	930240	75	36	18,000	104,000	97	450		
Detroit Reservoir	do	930240	80	36	100,000	340,000	377	438	340,000	
Byars Creek	Breitenbush River	930240	85	36	11,000	63,000	250	104	50,000	
Tunnel	North Santiam River	930240	86	36	25,000	106,000	290	164	150,000	
Minto	do	930240	88	36	18,000	72,900	250	124	150,000	
Marion Lake	Marion Creek	930240	90	36	22,000	154,100	1,500		38,000	
Hayden Bridge	McKenzie River	930260	05	36	9,000	73,600	90	1,065		
Deerhorn	do	930260	15	36	4,000	32,400	44	1,065		
Vida	do	930260	20	36	30,000	240,000	200	899		
Quartz Creek	do	930260	25	36	18,000	142,000	80	899		
Blue River	Blue River	930260	30	36	16,000	71,000	330	88	140,000	
Lower Cougar	McKenzie River	930260	35	36	30,000	236,500	228	703		
Cougar	South Fork McKenzie River	930260	40	36	25,000	122,000	418	202	182,000	
Hardy Creek	do	930260	50	36	3,300	28,900	290			
Augusta Creek	do	930260	55	36	4,900	42,700	430			
McKenzie Branch	McKenzie River	930260	58	36	10,000	78,800	85	501		
Horse Creek	Horse Creek	930260	60	36	5,300	46,400	330			
Foley Springs	do	930260	62	36	4,900	42,900	280			
Rainbow Creek	Separation Creek	930260	64	36	8,700	76,200	720			
Harvey Creek	do	930260	66	36	7,000	61,000	850			
Three Sis	do	930260	68	36	9,100	79,700	1,350		5,300	
Belknap	McKenzie River	930260	70	36	35,000	229,000	385			
Deer Creek	do	930260	75	36	9,000	71,000	170			
Smith River	do	930260	80	36	9,000	79,000	300			

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN—Continued									
WILLAMETTE—continued									
Lower Falls	McKenzie River	930260	85	36	11,300	90,200	270		
Middle Falls	do	930260	90	36	4,400	35,100	150		
Upper Falls	do	930260	95	36	5,600	44,900	250	90	
Dexter	Middle Fork Willamette River	930280	05	36	15,000	80,000	56	1,000	
Meridian	do	930280	10	36	115,000	286,000	238	991	368,000
Lookout Point	do	930280	20	36	20,000	112,000	127	915	
Mile 67	North Fork	930280	25	36	26,000	95,500	300	230	78,000
North Fork Site 2	do	930280	30	36	3,000	22,000	150		
North Fork Site 1	Salmon Creek North Fork	930280	34	36	18,500	103,000	580		
Salmon Creek	Salmon Creek	930280	36	36	30,000	162,000	1,020		
Waldo Lake	Black Creek	930280	40	36	21,000	29,000	1,960	30	220,000
Hills Creek	Middle Fork Willamette River	930280	45	36	20,000	110,000	275	389	221,000
Mile 56	do	930280	50	36	6,800	48,000	215		
Boulder Creek	do	930280	60	36	7,000	48,200	370		
Staley Creek	do	930280	70	36	6,500	45,600	390		
Swift Creek	do	930280	80	36	7,000	42,200	800		
Rocky Point	Row River	930290	20	36	4,500	33,200	175	234	70,000
Disston	do	930290	40	[1] 36				138	44,000
Total					1,328,450	6,731,200	27,163		3,216,150
SANDY		930320							
Marmot	Sandy River	930320	10	36	33,500	231,900	600	262	
Welches	Salmon River	930320	20	36	9,800	63,800	350	100	
Linney	do	930320	30	36	18,600	123,900	820	54	20,280
Meadows	do	930320	40	36	5,200	35,400	420	40	19,680
Total					67,100	455,000	2,190		39,960
COLUMBIA MAIN STREAM		930331							
Bonneville	Columbia River	930331	05	[2] 36		761,000	66	240,000	
LITTLE WHITE SALMON		930331							
Rock Hatch	Little White Salmon River	930331	10	46	12,700	83,800	515	120	
Rock Creek	do	930331	20	46	14,200	94,000	645	110	
Total					26,900	177,800	1,160		
WHITE SALMON									
Elevation 295	White Salmon River	930332	10	46	3,300	25,100	65	700	

WHITE SALMON		930332							
Elevation 295	White Salmon River	930332	10	46	3,200	25,100	65	300	
Husum Bridge	do	930332	20	46	12,900	99,400	290	290	
Gilmer Creek	do	930332	30	46	14,700	111,700	420	266	
Foot of Falls	do	930332	40	46	18,200	138,100	550	250	
Splash Dam	do	930332	50	46	6,050	45,900	270	169	
Trout Creek	do	930332	70	46	2,550	20,800	310	69	
Total					57,600	441,000	1,905		
KLICKITAT		930340							
Foot of Rapids	Klickitat River	930340	10	46	4,600	35,300	75	1,140	
Head Box Canyon	do	930340	20	46	15,200	116,400	295	1,090	
Wright	do	930340	30	46	5,500	41,900	120	995	
Little Klickitat	do	930340	40	46	12,000	92,000	290	663	
Alvords Bridge	do	930340	45	46	12,300	94,400	300	528	
Outlet Creek	do	930340	50	46	30,700	236,400	827	347	
Big Muddy River	do	930340	55	46	15,500	118,300	563	254	
Middle Big Muddy	Big Muddy Creek	930340	60	46	8,200	56,400	968	23	
West Fork	West Fork Klickitat River	930340	65	46	3,800	30,000	467	83	
Do	Klickitat River	930340	75	46	2,800	21,900	170	150	
Castile Ford	do	930340	80	46	4,800	29,500	280	129	
McCreedy Creek	do	930340	90	46	3,100	23,700	335	85	
Klickitat Reservoir	do	930340	95	46				41	135,000
Total					117,500	897,200	4,690		135,000
COLUMBIA MAIN STREAM		930350							
The Dalles	Columbia River	930350	10	46	1,120,000	6,860,000	88	237,000	33,000
DESCHUTES		930360							
Moody	Deschutes River	930361	15	36	64,000	377,000	132	10,500	
Lockit	do	930361	20	36	34,000	201,500	70		
Reclamation	do	930361	30	36	46,000	271,600	95		
Sinamox	do	930361	35	36	43,000	254,000	90		
Oak Brook	do	930361	40	36	31,000	184,000	65		
Sherar Falls	do	930361	45	36	36,000	210,000	75		
Oak Springs	do	930361	50	36	13,000	79,000	35		
Maupin	do	930361	60	36	48,000	280,000	120		
Frieda	do	930361	65	36	58,000	341,600	145		
White Horse	do	930361	70	36	38,500	285,600	138		
Pelton	do	930361	85	36	108,000	325,000	152		5,000
Round Butte	do	930361	90	36	225,000	700,000	285		
Riggs	Metolius River	930362	10	36	12,800	100,000	135		
White Water	do	930362	20	36	20,600	153,300	260		
Jefferson	do	930362	30	36	26,500	197,100	400		
Jacks Creek	do	930362	40	36	11,900	88,500	300		
Total					816,000	4,048,200	2,497		5,000

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN—Continued									
COLUMBIA MAIN STREAM		930370							
John Day	Columbia River	930370	10	46	1,190,000	7,400,000	95	226,000	----------
McNary	do	930393	10	36	980,000	7,000,000	85	215,000	----------
Total					2,170,000	14,400,000	180	----------	----------
SNAKE		930400							
Ice Harbor	Snake River	930411	10	46	325,000	2,000,000	100	109,000	----------
Little Monumental	do	930411	20	46	300,000	1,850,000	93	108,500	----------
Little Goose	do	930413	10	46	325,000	2,015,000	100	104,000	----------
Large Granite	do	930413	20	46	275,000	1,630,000	82	103,400	----------
Lapwai	Clearwater River	930421	10	11	73,000	285,000	35	9,588	----------
Myrtle	do	930421	20	11	131,000	513,000	66	8,589	----------
Agatha	do	930421	30	11	105,000	407,000	53	8,438	----------
Peck	do	930421	40	11	70,000	272,000	35	8,387	----------
Bruces Eddy	North Fork Clearwater River	930422	10	11	270,000	1,200,000	367	2,520	510,000
Elkberry	do	930422	30	11	420,000	1,603,000	523	2,015	1,390,000
Rock Creek	do	930422	40	11	364,000	1,419,000	600	1,160	593,000
Lost Creek	do	930422	55	11	13,000	50,000	49	728	----------
Fisher Creek	do	930422	60	11	10,000	73,000	268	585	----------
Kelley Creek	do	930422	70	11	33,000	128,000	400	360	270,000
Jim Ford	Clearwater River	930423	10	11	26,000	227,800	66	5,290	----------
Kooskia	do	930425	10	11	550,000	1,568,000	514	4,890	3,100,000
Jerry Johnson	Lochsa River	930426	10	11	46,000	177,800	290	600	----------
Wendover	do	930426	20	11	105,000	446,800	718	465	405,000
Selway Falls	Selway River	930426	45	11	65,000	252,300	140	1,812	----------
Meadow Creek	Meadow Creek	930426	50	11	2,500	18,700	210	250	----------
Wolf Creek	Selway River	930426	55	11	103,000	400,300	286	1,495	66,000
Moose Creek	do	930426	60	11	240,000	718,300	592	1,345	830,000
Running Creek	do	930426	65	11	50,000	197,000	302	650	59,000
White Cap	do	930426	70	11	68,000	262,800	483	520	360,000
Meadow Creek	South Fork Clearwater River	930428	10	11	73,000	284,700	810	----------	----------
Silver Creek	do	930428	20	11	24,000	91,100	430	----------	----------
Newsome Creek	do	930428	30	11	50,000	198,000	1,040	420	260,000
Clarkston	Snake River	930431	05	11	180,000	710,000	46	93,500	----------
Asotin	do	930431	10	11	400,000	2,146,000	140	93,400	----------
Narrows	Grande Ronde River	930432	20	46	49,000	210,200	150	----------	----------
Rays Ferry	do	930432	30	46	106,000	464,300	379	3,390	358,000
Troy Reservoir	do	930432	45	36	102,000	446,800	410	3,215	500,000
Beaver Creek	Wenaha River	930432	50	36	9,750	68,700	1,366	----------	----------
The Forks	do	930432	55	36	9,750	68,700	1,366	----------	----------

Rays Ferry	do	930432	45	36	102,000	446,800	410	3,215	500,000
Troy Reservoir	do								
Beaver Creek	Wenaha River	930432	50	36	9,750	68,700	1,366		
The Forks	do	930432	55	36	2,900	21,500	1,000	56	
Elbow Creek	Grande Ronde	930432	58	36	56,000	245,300	302		71,000
Rondowa	do	930432	60	36	76,000	332,900	420	2,555	660,000
Little Minam	Minam River	930432	75	36	5,600	43,600	590	171	
North Minam	do	930432	80	36	4,800	36,800	950	90	
Little Indian	Indian Creek	930432	85	36	2,660	9,000	616		14,500
Catherine Creek	Catherine Creek	930432	90	1 36					22,300
Large Grande Ronde	Grande Ronde River	930432	95	36	3,930	12,000	186		175,000
Nez Perce	Snake River	930433	10	11	880,000	3,223,000	645	89,100	4,800,000
Do	do	930436	10	36	1,100,000	4,170,000	615	89,100	4,800,000
Freedom	Salmon River	930441	10	11	260,000	1,069,000	222	13,320	180,000
Round Valley	Little Salmon River	930442	10	1 11				220	230,000
Crevice	Salmon River	930443	10	11	500,000	2,423,000	511	12,460	1,030,000
Warren	Warren Creek	930443	20	11	91,000	446,800	3,479	177	39,000
Raines	South Fork Salmon River	930444	03	11	28,000	109,500	140	1,290	
Porphyry	do	930444	05	11	32,000	121,800	159	1,260	
Rattlesnake	do	930444	15	11				1,215	285,000
Jeanott	do	930444	20	11	8,000	69,000	160	1,105	
Bear Creek	do	930444	25	11	10,000	84,000	200	1,070	
Tailholt	do	930444	30	11	6,000	50,000	120	1,030	
Long Gulch Reservoir	Secesh River	930444	33	1 11				120	91,000
Deadman	East Fork South Fork River	930444	36	11	5,300	43,700	320	405	
Regan	do	930444	38	11	5,300	43,700	320	396	
Parks	do	930444	40	11	5,600	46,000	370	342	
Half Way	Johnson Creek	930444	54	11	3,100	27,200	520	88	
Rustican	do	930444	56	11	3,300	28,900	580	70	
Lunch Creek	do	930444	58	1 11				60	19,800
Buckhorn	South Fork Salmon River	930444	84	11	5,000	43,800	280	266	
Reed	do	930444	86	11	3,200	28,000	170	266	30,000
Poverty Falls	do	930444	88	11	4,600	39,000	325	170	
Bear Hill	do	930444	90	11	5,100	44,700	390	140	
Knox	do	930444	94	11	2,800	24,500	240	140	50,000
Growler Rapids	Salmon River	930445	20	11	248,000	968,000	305	10,190	300,000
Black Canyon	do	930445	25	11	238,000	926,800	332	9,790	425,000
Pinnacle Park	do	930445	30	11	243,000	944,300	376	9,170	445,000
Lewis	Middle Fork, Salmon River	930446	16	11	141,000	550,100	433	2,735	319,000
Monumental	Big Creek	930446	26	11	3,500	28,500	320	353	
Aparejo	Middle Fork Salmon River	930446	34	1 11				1,900	1,360,000
Pungo	do	930446	66	11	8,000	67,500	170	900	
Risley	do	930446	68	11	5,300	44,800	135	785	
Steelhead	do	930446	70	11	5,400	46,100	145	659	
Sheepeater	do	930446	78	11	7,700	66,000	240	510	
Deerhorn	do	930446	80	11	5,300	45,400	170	470	
Fuller	do	930446	84	11	5,800	49,800	190	442	
Salmon Falls	do	930446	86	11	3,900	34,200	140	375	
Fall Creek	do	930446	88	11	5,500	47,800	200	360	
Chinook	do	930446	90	11	5,200	45,500	200	338	
Bear Valley	do	930446	94	11	7,800	68,300	310	338	235,000
Rood	Panther Creek	930447	07	11	3,200	25,600	290	418	
Deer	do	930447	09	11	5,000	37,100	450	402	
Jureano	do	930447	11	11	3,000	23,700	310	340	

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN—Continued									
SNAKE—continued									
Shoup	Salmon River	930447	30	11	14,000	110,000	90		
Indianola	do	930447	40	11	71,000	276,800	248	5,510	265,000
Lower Lemhi	do	930449	03	11	2,500	11,000	75	3,700	
12 Mile Creek	do	930449	05	11	5,800	46,300	45	3,500	
Camp Creek	do	930449	10	11	8,700	69,600	69	3,450	
Rattlesnake	do	930449	15	11	16,700	133,100	134	3,400	
12 Ja 16	do	930449	20	11	4,400	35,000	36	3,350	
McKim Creek	do	930449	25	11	17,000	136,000	140	3,300	
Pahsimeroi	do	930449	30	11	61,000	237,400	297	3,210	1,042,000
Challis	do	930449	40	11	5,000	25,000	200		5,000
Clayton	do	930449	50	11	3,300	26,200	52	1,160	
Sullivan Springs	do	930449	55	11	8,100	63,100	122	1,100	
Holman Creek	do	930449	60	11	5,900	46,100	95	1,000	
Badger Creek	do	930449	65	11	7,600	58,900	122	951	
Muley Creek	do	930449	75	11	3,100	24,100	53	841	
Yankee Fork	do	930449	80	11	4,000	30,500	77	644	
American Creek	do	930449	85	11	4,300	33,000	84	638	
Elk Horn Creek	do	930449	90	11	3,400	25,800	70	570	
Stanley Basin	do	930449	95	11	8,800	66,600	211	535	220,000
The Rapids	Imnaha River	930452	20	36	5,700	39,300	950		
Coverdale Reservoir	do	930452	40	136				79	67,000
HellsCanyon	Snake River	930453	10	11	450,000	2,026,000	602	74,000	3,880,000
Do	do	930453	10	36	450,000	2,025,000	602	74,000	3,880,000
Coverdale	McGraw Creek	930453	20	36	34,000	201,500	2,300	79	
Mason	Powder River	930454	10	36	3,000	6,000	120		60,000
Garden Valley	South Fork Payette River	930464	05	11	45,000	135,000	280	1,200	1,250,000
Big Pine Creek	do	930464	10	11	7,800	63,500	160		
Pine Flat	do	930464	15	11	4,300	35,200	90		
Oxbow Bend	do	930464	20	11	4,400	36,400	95		
12 HG 13	do	930464	40	11	3,900	32,200	100		
12 HG 12	do	930464	45	11	6,500	53,100	200		
12 HG 11	do	930464	50	11	4,200	34,600	130		
12 HG 10	do	930464	55	11	2,800	23,200	90		
12 HG 9	do	930464	60	11	5,000	42,400	220		
12 HG 8	do	930464	65	11	4,600	40,300	225		80,000
Elk Lake	do	930464	70	11	3,700	28,000	1,000		
Clear Creek	do	930464	75	11	3,000	22,500	730		
Warm Springs	do	930464	88	11	2,900	22,300	660	52	

Lower Scriver	Scriver Creek	930464	94	11	90,000	411,000	820	893	5,000
Upper Scriver	do	930464	96	11	30,000	208,000	445	893	
Lucky Peak	Boise River	930472	05	11	43,000	213,000	240	2,650	280,000
Arrow Rock	do	930472	08	11	13,000	42,000	250	2,200	286,000
12 HD 1	do	930472	09	11	5,600	43,700	115	830	
Twin Springs	do	930472	10	11	25,000	114,000	312	830	150,000
12 HD 15	North Fork Boise River	930472	14	11	7,700	63,200	307		
Barber Flat	do	930472	18	[1] 11				325	24,000
12 HD 12	do	930472	26	11	3,000	23,800	600		
Alex Flats	Middle Fork Boise River	930472	28	11	2,500	19,700	162	350	20,000
12 HD 11	do	930472	30	11	3,500	27,000	220		
12 HD 20	South Fork Boise River	930472	54	11	3,700	29,500	105		
Anderson Ranch	do	930472	60	[2] 11	13,500		323	980	
Casey Ranch	do	930472	64	11	3,900	32,000	145	635	
12 HD 19	do	930472	68	11	2,800	23,200	120		
Bascum Reservoir	do	930472	70	11	3,600	29,000	193	449	62,000
12 HD 18	do	930472	74	11	3,300	25,500	208		
12 HD 16	do	930472	90	11	4,400	33,600	860		
Guffey	Snake River	930475	10	11	40,000	170,000	37	42,000	
C. J. Strike	do	930475	40	11	82,500	410,000	92		
Upper Bliss	do	930475	70	11	100,000	385,000	78	32,300	
Box Canyon Spring	do	930477	10	11	2,600	22,800	132		
Kanoka Rapids	do	930477	20	11	15,300	129,800	86		
Rock Creek	Rock Creek Snake	930477	30	11	4,100	32,500	300		
Auger Falls	Snake River	930477	40	11	9,800	80,600	154		
12 GR 2	do	930477	50	11	6,800	59,600	200		
Dry Creek	do	930477	60	11	4,700	41,200	161		
Eagle Rock	do	930477	70	11	23,800	167,100	47	22,500	
American Falls	do	930477	80	11	30,000	120,000	107	22,480	
Shelley	do	930479	20	11	4,700	38,900	28		
Teton River	Teton River	930482	10	11	17,300	139,200	600		
Falls River	Falls River	930484	10	11	14,600	117,100	500		
12 GH 4	Henrys Fork	930485	10	11	9,500	75,000	140	660	
Warm River	Warm River	930486	10	11	3,600	30,100	250		
Big Lo Falls	Henrys Fork	930487	10	11	17,600	139,000	270		
Palisades	Snake River	930491	20	11	112,500	521,400	245	5,200	1,200,000
Blind Canyon	do	930493	10	49	122,000	537,000	327	3,497	765,000
Total					11,193,340	49,886,300	48,947		33,023,600
YAKIMA		930520							
Chandler	Yakima River	930521	10	46	12,000	50,000	118		
Lower Wapato	Simcoe River	930522	10	46	25,000	103,000	613		
Upper Wapato	do	930522	20	46	41,600	167,000	1,000		
Tieton Division	Tieton River	930524	10	46	12,700	56,000	441	187	
Below elevation 1,765	Naches River	930524	20	46	7,300	61,000	145		
Rattle Snake	do	930524	30	46	10,000	84,000	207	610	
Elevation 2,265	do	930524	40	46	14,000	118,000	293	420	
Bumping River	do	930524	50	46	12,200	104,000	275	342	
Below Americ[illegible] River	Bumping River	930524	60	46	6,170	53,500	178	189	
Elevation 3,165	do	930524	70	46	7,000	61,000	447		66,500
Below Ples Valley	American River	930524	80	46	10,700	93,700	662	72	73,000

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos. River	Code Nos. Site	Code Nos. State	Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
COLUMBIA RIVER BASIN—Continued									
YAKIMA—continued									
Naches Meadows	Naches River	930524	90	46	2,700	23,400	557	64	
Roza Canal	Yakima River	930525	10	46	10,000	72,000	160		
Teanaway Division	do	930525	20	46	16,000	59,000	80	738	
Below B Salmon	Clealum River	930525	30	46	4,140	35,000	138	131	
Elevation 2,545	do	930525	40	46	4,640	39,400	155	131	
Cooper Lake Division	West Fork Clealum River	930526	50	46	3,020	26,400	318	28	42,000
Waptus Lake	Middle Fork Clealum River	930526	60	46	3,050	26,700	467	42	31,000
Fish Lake	North Fork Clealum River	930526	70	46	5,910	51,800	845	23	29,000
Total					208,130	1,284,900	7,099		241,500
COLUMBIA MAIN STREAM		930531							
Richland	Columbia River	930531	10	46	515,000	2,716,000	64	103,000	
Priest Rapids	do	930531	20	46	1,590,000	8,785,000	150	95,500	
Rock Island	do	930531	30	[3] 46	150,000	927,000	54	95,500	
Total					2,255,000	12,428,000	268		
WENATCHEE		930532							
Elevation 612	Wenatchee River	930532	05	46	12,400	103,400	83	1,330	
Elevation 695	do	930532	10	46	31,900	267,200	210	1,280	
Dryden Powerplant	do	930532	12	46	8,050	70,500	62	1,150	
Peshastin Creek	Peshastin Creek	930582	15	46	2,380	16,600	575	50	
Below elevation 1,110	Wenatchee River	930532	20	46	24,400	206,700	143	990	
Elevation 1,110	Icicle Creek	930532	25	46	5,290	37,700	286	200	
8 Mile Flat	do	930532	30	46	13,500	96,200	704	180	1,080
Eight Mile	do	930532	35	46	8,290	58,700	585	110	1,900
Trout Creek	do	930532	40	46	2,310	16,600	235	70	
Elevation 1,110	Wenatchee River	930532	45	46	27,400	234,800	175	700	
G. N. Powerplant	do	930532	50	46	27,800	239,100	179	660	
Chiwaukum	do	930532	55	46	20,300	175,000	135	590	
Plain	do	930532	58	46	63,000	245,300	200	591	1,050,000
Chiwawa	Chiwawa River	930532	60	46	45,000	175,000	550	169	333,000
Wenatchee	Little Wenatchee	930532	65	46	2,150	15,700	150	80	11,900
White River	White River	930532	70	46	4,500	32,000	355	61	37,000
Total					298,670	1,990,500	4,627		1,434,880
COLUMBIA MAIN STREAM		930533							
Rocky Reach	Columbia River	930533							

COLUMBIA MAIN STREAM		930533							
Rocky Reach	Columbia River	930533	10	46	910,000	4,967,000	93	86,900	
ENTIAT		930534							
Entiat Division	Entiat River	930534	05	46	3,600	27,200	358	348	
Mad Creek	do	930534	10	46	2,100	15,700	270	221	
Total					5,700	42,900	628		
CHELAN		930540							
Railroad Creek	Railroad Creek	930540	10	46	7,780	65,700	1,155		27,500
Stehekin	Stehekin River	930540	20	46	14,800	100,700	405		
Agnes Creek	do	930540	30	46	14,700	100,700	555		
Total					37,280	267,100	2,115		27,500
COLUMBIA MAIN STREAM		930550							
Wells	Columbia River	930550	10	46	588,000	3,487,700	64	85,000	
OKANOGAN		930572							
McLaughlin	Okanogan River	930572	05	46	2,200	15,800	24		
Below 964	Similkameen River	930572	10	46	2,750	21,000	54	3,450	
Similkameen	do	930572	20	46	84,000	230,000	244	3,445	1,310,000
Total					88,950	266,800	322		1,310,000
COLUMBIA MAIN STREAM		930573							
Chief Joseph	Columbia River	930573	10	46	1,536,000	8,681,000	170	75,000	
SPOKANE		930600							
Little Falls	Spokane River	930610	10	[3] 46	4,400	27,000	78	6,380	
Long Lake	do	930610	20	[3] 46	13,500	80,000	169	6,120	
Ninemile	do	930630	05	[3] 46	16,500	79,000	61	5,390	
Bowl Pitcher	do	930630	10	46	60,000	289,000	85	5,390	
Monroe Street	do	930650	03	[3] 46	23,800	144,000	72	4,350	
Upper Falls	do	930650	05	[3] 46	16,000	89,000	60	4,350	
Water Works	do	930650	10	[3] 46	9,300	57,000	33	4,350	
Crossing	do	930650	20	46	8,850	69,200	45		
Post Falls	do	930650	30	[3] 11	10,200	55,000	55	3,880	
Springston	Coeur d'Alene River	930662	10	11	32,000	140,000	125	1,468	2,595,000
Leland Glen	do	930662	20	11	40,800	130,000	270	594	370,000
Teddy Creek	do	930662	30	11	11,000	48,600	290	300	150,000
Avery	St. Joe River	930664	10	11	29,000	117,000	280	469	150,000
Total					275,350	1,324,800	1,623		3,265,000

See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN—Continued									
KETTLE		930740							
Orient	Kettle River	930, 741	10	46	35, 000	131, 400	180	4, 000	280, 000
Curlew	do	930, 743	10	46	9, 000	35, 000	150	2, 000	157, 000
Total					44, 000	166, 400	330		437, 000
BIG SHEEP CREEK		930, 750							
Lower Big Sheep	Big Sheep Creek	930, 750	10	46	3, 800	33, 100	520	171	
Upper Big Sheep	do	930, 750	20	46	1, 800	14, 900	302	168	25, 000
Total					5, 600	48, 000	822		25, 000
CLARK FORK		930, 800							
Boundary	Pend Oreille River	930, 813	10	46	1, 428, 000	4, 222, 000	322	25, 200	
Box Canyon	do	930, 813	20	46	60, 000	248, 000	41	24, 930	
Albeni Falls	do	930, 819	10	11	42, 600	289, 000	32	24, 200	1, 140, 000
Priest 4	Priest River	930, 821	40	11	27, 300	66, 000	109	578	870, 000
Cabinet Gorge	Clark Fork	930, 851	10	11	200, 000	1, 000, 000	106	21, 800	
Weare	Bull	930, 851	20	25	2, 200	8, 800	100		149, 000
Noxon Rapids	Clark Fork	930, 851	25	25	200, 000	815, 000	73	21, 800	
Trout Creek	do	930, 851	30	25	292, 000	1, 078, 000	99	21, 800	
Thompson Falls	do	930, 851	40	25	50, 000	391, 000	60	20, 940	
Paradise	do	930, 853	10	25	1, 008, 000	2, 138, 000	243	19, 900	4, 080, 000
Swan Lake	Swan	930, 864	20	25	4, 800	26, 000	54	655	234, 000
Hungry Horse	South Fork Flathead River	930, 866	10	25	285, 000	1, 176, 000	484	1, 635	2, 980, 000
Coram	Flathead River	930, 867	10	25	114, 000	341, 600	108	2, 780	
Canyon Creek	North Fork Flathead River	930, 868	10	25	116, 000	263, 000	154	1, 610	
Glacier View	do	930868	20	25	210, 000	563, 000	402	1, 460	3, 160, 000
Belton	Middle Fork Flathead River	930868	30	25	152, 400	480, 000	400	950	1, 190, 000
Quartz Creek	Clark Fork	930870	10	25	123, 000	392, 000	130	9, 710	
Alberton	do	930870	20	25	32, 600	201, 000	70	9, 000	
Bonner	Blackfoot River	930892	10	25	22, 300	85, 800	165	2, 280	
Ninemile Prairie	do	930892	20	25	74, 000	157, 600	307	2, 030	960, 000
Myrick	Clearwater River	930892	30	25	1, 800	7, 008	100		131, 500
Ovando Branch	Blackfoot River	930892	40	25	19, 400	74, 500	250	1, 280	950, 000
Helnze	North Fork Blackfoot River	930892	50	25	2, 500	9, 800	380	400	82, 800
Lincoln Canyon	Blackfoot River	930892	60	25	2, 350	9, 200	110	400	211, 800

Finlen	Rock Creek	930894	10	25	14,100	55,200	210		123,600
Quigley	do	930894	20	25	14,300	56,100	240		78,100
Atkins	do	930894	30	25	8,950	35,000	174		248,300
Joy	do	930894	40	25	10,500	41,200	234		251,600
Sapphire	West Fork Rock Creek	930894	50	25	3,580	14,000	210		101,400
Total					4,521,680	14,243,808	5,367		16,942,100
KOOTENAI		930920							
Moyie Canyon	Moyie River	930924	10	11	36,000	94,200	213	755	
Meadow Creek	do	930924	20	[1] 11					322,000
Katka	Kootenai	930925	10	11	552,000	1,796,000	271	11,780	
Yaak Canyon	Yaak River	930926	10	25	25,000	96,000	250	750	
Longmeadow	do	930926	20	[1] 25					435,000
Libby	Kootenai	930927	10	25	980,000	1,735,000	353	10,000	4,250,000
Total					1,593,000	3,721,200	1,087		5,007,000
NEHALEM		931000							
Stonehill	Nehalem River	931120	10	36	17,000	74,000	45	667	
Nehalem Falls	do	931120	20	36	125,000	547,000	330	645	
Elsie	do	931120	30	36	32,000	140,000	205	500	1,500,000
Total					174,000	761,000	580		1,500,000
WILSON		931200							
12 RA 41	Wilson River	931200	10	36	2,770	18,100	80	155	
12 RA 40	do	931200	20	36	3,630	23,700	110	140	
12 RA 39	do	931200	30	36	4,200	27,400	145	125	
12 RA 38	do	931200	40	36	3,280	21,400	165	90	
12 RA 37	do	931200	50	36	4,200	27,400	380	50	
Total					18,080	118,000	880		
TRASK		931320							
12 RA 20	Trask River	931320	20	36	2,500	19,300	90	150	
12 RA 19	do	931320	30	36	4,500	29,800	190	130	
12 RA 23	do	931320	40	36	1,500	9,900	110	70	
12 RA 22	do	931320	50	36	2,500	16,800	260	60	
12 RA 21	do	931320	60	36	3,000	19,800	900	6	
Total					14,000	95,600	1,550		
NESTUCCA		931400							
12 RA 29	Nestucca River	931400	10	36	3,400	23,600	170	95	
12 RA 28	do	931400	20	36	2,400	17,700	210	60	
12 RA 27	do	931400	30	36	4,300	33,200	520	40	
12 RA 26	do	931400	40	36	1,500	13,100	870	12	15,000
Total					11,600	87,600	1,770		15,000

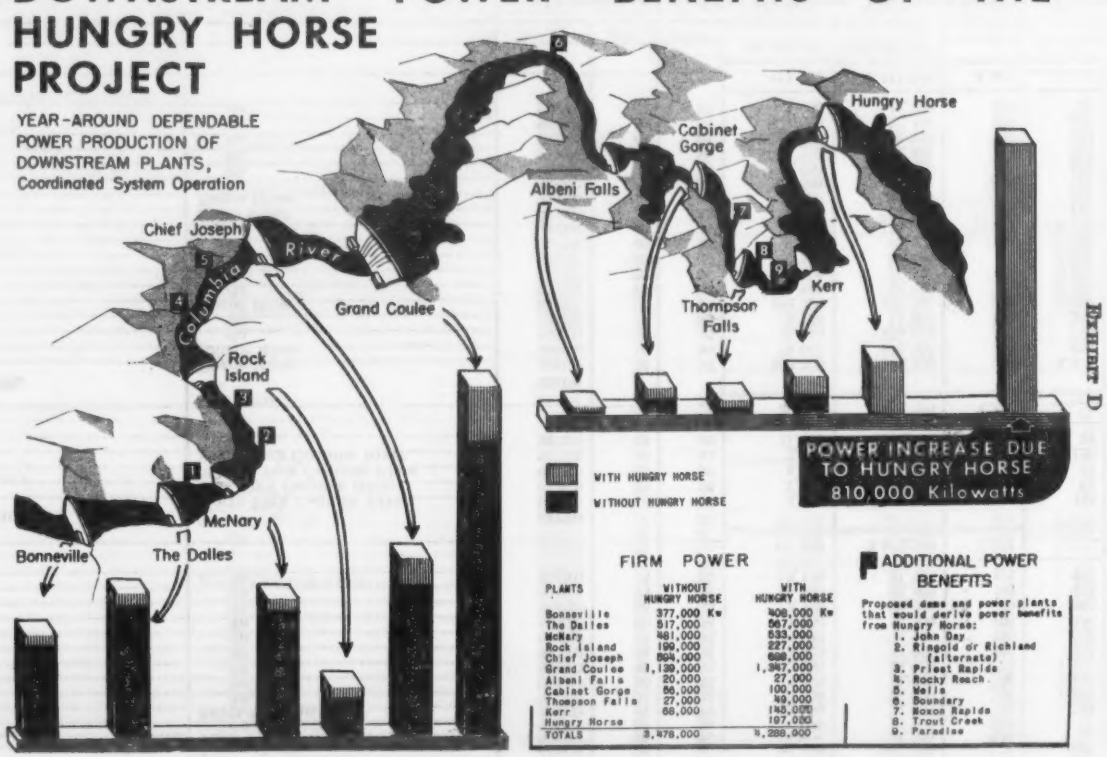
See footnotes at end of table.

Undeveloped waterpower river basins draining into Pacific Ocean between California and Canada—Continued

River basin, project, or site	Stream	Code Nos.			Capacity (kilowatts)	Average annual generation (1,000 kilowatt-hours)	Gross head (feet)	Drainage area (square miles)	Usable storage (acre-feet)
		River	Site	State					
COLUMBIA RIVER BASIN—Continued									
SILETZ		931600							
Euchre Creek	Siletz River	931600	10	36	14,200	117,000	255	112	
Sunshine Creek	do	931600	20	36	20,800	150,000	345	109	41,400
Falls	do	931600	30	36	12,700	75,300	300	75	160,000
Valsetz	South Fork Siletz River	931600	40	36	1,900	13,100	235	16	70,000
Total					49,600	355,400	1,135		271,400
SIUSLAW		933200							
12 RA 6	Siuslaw River	933200	10	36	10,000	42,000	70	650	
Triangle Lake	Lake Creek	933200	20	36	5,000	35,000	280	50	72,000
12 RA 5	Siuslaw River	933200	30	36	22,000	103,000	180	450	
12 RA 4	do	933200	40	36	15,000	67,600	135	267	145,000
12 RA 3	do	933200	50	36	8,000	34,300	135	130	150,000
Total					60,000	281,900	800		367,000
SMITH		933400							
12 RB 3	Smith River	933400	10	36	3,000	13,000	130	170	
12 RB 1	do	933400	30	36	5,400	23,600	320	36	40,000
Total					8,400	36,600	450		40,000
UMPQUA		934000							
Loon Lake	Mill Creek	934200	20	36	6,500	55,900	385	84	100,000
Lake Creek	Lake Creek	934200	30	[1] 36				49	40,000
Scottsburg	Umpqua River	934300	10	36	38,100	290,000	100	4,010	85,000
Kelleys Smith	do	934300	20	36	30,800	235,600	85	3,680	32,000
Kellogg	do	934300	30	36	23,500	196,000	70	3,650	
Wolf Creek	do	934300	40	36	37,000	298,000	145	3,600	422,000
Winchester	North Umpqua River	934410	10	36	13,400	89,000	80	1,290	12,000
Oak Creek	do	934410	20	36	11,250	86,500	70	1,290	14,000
Horsehoe Branch	do	934410	30	36	14,000	98,300	90	1,230	16,000
Glide	do	934410	40	36	9,000	62,200	60	1,200	14,000
Rock Creek	do	934410	50	36	51,000	263,000	221	886	
Boundary	do	934410	60	36	44,000	216,000	187	847	
Steamboat	do	934430	10	36	16,300	113,000	190	670	19,000
Copeland	do	934430	20	36	24,300	175,000	290	650	24,800
Soda Springs	do	934430	30	36	11,250	55,000	114	500	800
Fish Creek	Fish Creek	934440	10	36	6,000	43,000	918	70	
Clearwater 2	Clearwater River	934460	10	36	26,000	87,600	750	55	
Clearwater 1	do	934460	20	36	15,000	15,700	661	40	
Bridge	North Umpqua River	934470	10	36	8,000	45,000	145	220	
Lower Lemolo	do	934470	20	36	20,000	162,000	750	190	

Bridge	North Umpqua River	934470	10	36	6,000	45,000	145	220	
Lower Lemolo	do	934470	20	36	20,000	162,000	750	190	
Upper Lemolo	do	934470	30	36	20,000	164,000	775	180	18,000
Lake Creek 3	Lake Creek	934480	10	36	3,600	9,750	325	80	
Lake Creek 1	do	934480	30	36	5,000	13,000	480	57	30,000
Roseburg	South Umpqua River	934600	10	36	3,000	22,000	50	1,730	
Dillard	do	934600	20	36	3,600	26,000	60	1,670	
Ruckles	do	934600	30	36	2,820	21,000	50	1,440	
Myrtle Creek	do	934600	40	36	3,880	28,000	70	1,270	
Riddle Division	do	934600	50	36	5,820	44,000	125	730	
Days Creek	do	934600	55	36	4,880	24,100	100	690	60,000
Perdue	do	934600	60	36	4,560	20,800	100	650	37,600
Coffee Creek	do	934600	65	36	3,120	20,000	80	590	
Tiller Division	do	934600	70	36	6,250	39,800	160	430	
Deadman Creek	do	934600	75	36	3,150	21,000	175	270	
Total					473,080	3,076,250	7,861		925,200
COQUILLE		937200							
12 RC 7	North Fork Coquille River	937200	10	36	4,500	39,400	180	143	155,000
12 RC 6A	East Fork Coquille River	937200	20	36	7,400	64,600	400	85	
12 RC 5	Middle Fork Coquille River	937200	30	36	4,600	40,300	720	42	
12 RC 3	South Fork Coquille River	937200	50	36	2,680	20,200	210	120	
12 RC 1	do	937200	60	36	11,500	101,100	1,720	30	37,000
Total					30,680	265,600	3,230		192,000
ROGUE		938100							
Copper Canyon	Rogue River	938100	10	36	300,000	1,141,800	450	4,870	600,000
Bald Mountain	Illinois River	938200	10	36	24,040	116,200	200	856	50,000
Clear Creek	do	938200	20	36	50,740	278,500	490	792	200,000
Kerby	do	938200	30	36	9,400	51,000	180	380	465,000
Ramey Falls	Rogue River	938300	20	36	100,000	429,700	300	3,680	140,000
Ament	do	938500	10	36	4,800	28,400	30	2,410	
Rock Point	do	938500	20	36	2,900	17,100	18	2,110	
Gold Hill	do	938500	30	36	10,500	61,700	65	2,050	
Reese Creek	do	938500	40	36	6,700	45,600	120	1,137	
Lewis Creek	do	938500	50	36	34,400	152,000	242	1,076	318,000
McNeil Creek	Butte Creek	938600	10	36	3,600	30,400	360	140	
Cascade	Rogue River	938700	10	36	15,300	90,600	230	583	
Propect No. 2	do	938900	10	[2] 36	16,000	58,400	606	577	
Riter Creek	do	938900	20	36	9,600	58,800	200	319	
Top Creek	do	938900	30	36	6,750	41,300	140	312	
Union Creek	do	938900	40	36	12,000	73,700	280	262	
Castle Creek	do	938900	50	36	8,500	52,500	200	187	
Hamaker	do	938900	60	36	3,000	18,500	200	59	22,300
Total					618,230	2,747,200	4,311		1,795,300
Grand total					34,728,670	1,657,949,882			

[1] Storage reservoir only.
[2] An additional installation in existing plant. Incremental capacity and generation.
[3] Redevelopment of existing development. Incremental capacity and generation.



PLANTS	WITHOUT HUNGRY HORSE	WITH HUNGRY HORSE
Bonneville	377,000 Kw	408,000 Kw
The Dalles	517,000	567,000
McNary	481,000	533,000
Rock Island	199,000	227,000
Chief Joseph	594,000	688,000
Grand Coulee	1,139,000	1,347,000
Albeni Falls	20,000	27,000
Cabinet Gorge	56,000	100,000
Thompson Falls	27,000	49,000
Kerr	68,000	145,000
Hungry Horse		197,000
TOTALS	3,478,000	4,288,000

Exhibit D

Down-River Power Generation Benefits Of Hells Canyon Dam Shown

Down-River Power Generation Benefits Of Hells Canyon Dam Shown

Not counting the flood control, navigation and other multi-purpose benefits of the proposed Hells Canyon dam to the Northwest's comprehensive river development program, this drawing illustrates how Hells Canyon storage would add 436,000 kilowatts of power to other plants on the system. According to the Cotton report, these downriver power benefits would almost equal the total output of the present Bonneville dam.

EXHIBIT F

STATEMENT OF GUS NORWOOD, EXECUTIVE SECRETARY, NORTHWEST PUBLIC POWER ASSOCIATION, VANCOUVER, WASH.

Relating to Hells Canyon Dam:

(*a*) Added downstream benefits.

(*b*) Alternative financing for Hells Canyon Dam.

The Northwest Public Power Association, whose member utilities serve about 1,750,000 people with electricity, has consistently advocated construction of the high Hells Canyon Dam since March 1948. Testimony by the association has been presented at all hearings and has been voluminous. The present statement will not duplicate previous testimony but is confined to new information.

ADDED DOWNSTREAM BENEFITS

A serious deficiency in the FPC hearing has been the failure to give Hells Canyon Dam credit for the downstream benefits at:

	Kilowatts
Nez Percé Dam	287,000
Clarkston Dam	23,000
Asotin Dam	81,000
Total	391,000

These benefits were omitted on the assumption that these projects might not be built or might be built after the midpoint in the 50-year payout period of Hells Canyon Dam.

I expect these dams to be operating well before 1980. I also look for additional generators to be installed at Bonneville and other downstream dams which will benefit from Hells Canyon Dam river regulation. In my view the attitude of the FPC staff has been cavalier in writing off these benefits. FPC also errs in taking a short-range view of only 50 years.

The additional 391,000 kilowatts to present prime power of 1,122,000 kilowatts will increase Hells Canyon Dam prime power contribution to the region at 1,513,000 kilowatts and will bring the cost of power considerably downward.

It is my understanding that Federal and other witnesses elected to omit these additional benefits on the ground of conjecture and because they already had a solid, adequate, and unchallengeable case by counting only the potential downstream benefits at completed dams (Bonneville), projects under construction (McNary and The Dalles), and projects authorized (John Day and four lower Snake River dams). With this view I disagree. The Congress should be fully aware of the maximum potentiality of the Hells Canyon Dam. That potential is not less than 1,513,000 kilowatts.

ALTERNATIVE FINANCING

Some people apparently are not opposed to the Hells Canyon Dam but are opposed to Federal financing of its cost. The people of the Pacific Northwest are increasingly aware of this problem and are working on proposals for alternative financing.

The purpose of my testimony here is to suggest that Congress preserve first the tremendous potential of the Hells Canyon Dam site by approving the project. Meanwhile we will make every possible effort to work out a plan of alternative financing.

Please note that the Hoover Commission recommended one and suggested another alternative method for financing these Federal dams which avoid the appropriations and budget process and which at any rate would not increase the national debt.

WATER RESOURCES AND POWER RECOMMENDATIONS 12 AND 13

The Hoover Commission's June 1955 Report on Water Resources and Power, volume 1, page 121, recommends seven Federal electric corporations which would permit building Hells Canyon Dam by means of electric revenue bonds. The text of these proposals is as follows:

Recommendation No. 12

That the Columbia River Basin system, the Hoover-Parker-Davis Dams administration, the Central Valley project of California, the Missouri River Basin project, the Southwestern Power Administration, and the Southeastern Power Administration all be incorporated under and made subject to the Government Corporation Control Act.

Recommendation No. 13

That they and the Tennessee Valley Authority be required to secure their capital for their future improvements, when authorized by the Congress, by issuing their own securities to the public without subordinating the present Federal investment, thus relieving the taxpayers of this burden. (In such instance, our recommendation No. 1h should be amended so as not to apply to the interest and amortization on such public issues and to allow them to pay these items from their own funds.)

THE ALTERNATIVE

On pages 123 and 124 the Commission lists an alternative along the lines of the Port of New York Authority as a means of financing. The full text of this proposal follows and shows another way in which the Federal high Hells Canyon Dam may be financed:

"There is a desirable alternative to some of the recommendations outlined in the previous chapters. However, we make no formal recommendation on the subject. The Federal power activities being immune from State regulation as to rates and service, and immune from State and local taxes, they have been able to expand bureaucratic empires within the States. With the completion of the present power projects, their number will probably reach about 30,000. The States are becoming more and more dependent on the Federal Government.

"What is fundamentally needed is for the States concerned in each of these Federal power regions to reassert their own vigor and independence.

"The Port of New York Authority offers a legal, financial, and administrative pattern for such action.

"Based on this pattern now tested by long experience, the States in these seven major Federal power regions could—

"1. Set up a compact among themselves as provided in the Constitution;

"2. Take over the Federal Government's power business in their region, agreeing:

"(*a*) To pay interest on the Federal Government's investment in the power segment of these multiple-purpose dams and other projects.

"(*b*) To pay back to the Federal Government the capital invested for hydroelectric installation over a period of 50 years and for steam installations over a period of 35 years.

"(*c*) To pay to the Federal Government whatever sum in lieu of taxes that might be agreed upon.

"(*d*) To subscribe that part of the costs allocated to power in any future Federal multiple-purpose projects in their regions and thus obtain that power without paying interest or amortization to the Federal Government.

"(*e*) To raise the capital for all these future needs by issuing to the public their own securities in the same way as the Port of New York Authority has found to be satisfactory and economical.

"(*f*) To fix their own rates for power as the New York Authority fixes the tolls through its tunnels.

"Such action would benefit the whole Nation by restoring State and local government. It would relieve the intolerable burden on the Federal budget. It would check the rise of centralized government and bureaucratic control."

COLUMBIA RIVER DEVELOPMENT CORPORATION

On April 1, 1954, the Northwest Public Power Association adopted a resolution calling for the drafting of new legislation to create the Columbia River Development Corporation, to acquire the Bonneville Power Administration, and to finance additional power facilities by issuance of electric revenue bonds.

An outline of this proposal was filed with the Hoover Commission 3 months later on June 29, 1954.

Three drafts of the Columbia River Development Corporation bill were prepared and published August 1954, October 1954, and March 1955. The last draft is

attached hereto as an appendix together with an explanatory news release and some notes.

A fourth draft will be ready in January 1956 and will reflect the reaction of Congress to the TVA revenue bond plan which is now scheduled for hearings.

Without discussing these financing plans in detail I respectfully submit to the committee that the Hells Canyon Dam bill is not an appropriation. It is entirely possible that an alternative financing plan will be in effect by the time construction starts on this project.

Excluding the finance question enables the Congress to vote on the pure question of maximum versus a wasteful partial development of the magnificent Hells Canyon hydroelectric and reservoir project.

Our studies show that the Hells Canyon Dam will produce at least 60 percent more power for at least 50 percent less cost per kilowatt-hour than the alternative private scheme.

The people of the Pacific Northwest are overwhelmingly in favor of the high Hells Canyon Dam. I should like to say again no one is in favor of the high Hells Canyon Dam except the people.

EXHIBIT G

HELLS CANYON DAM FACT SHEET

1. The proposed Hells Canyon Dam will provide full development of all of the waterpower potential of the Hells Canyon Dam site.

2. Hells Canyon Dam will provide the consumer 60 percent more power for at least 35 percent less cost per kilowatt-hour. In a nutshell that is the conclusion to be drawn from over 20,000 pages of testimony before the Federal Power Commission.

3. The FPC hearing has become the basis for defining an important principle with respect to conservation of natural resources which is defined as the Hells Canyon principle. It is essentially a restatement and application of Abraham Lincoln's guiding principle, "The legitimate object of government is to do for the people what needs to be done, but which they cannot, by individual effort, do at all, or do so well, for themselves."

4. The Hells Canyon principle states that within the limits of Federal jurisdiction when the full or maximum economically feasible development of a hydroelectric dam site cannot be achieved by private or local public financing then the issue should be referred to Congress which should normally provide for Federal financing in order to do the full job.

5. The basis for this principle is the tremendous leverage of low-cost Federal financing using 2½ percent interest. This is illustrated by the first full year's operating statement for Hungry Horse Dam, the twin brother of Hells Canyon Dam. Last year of the $2.93 million costs at Hungry Horse Dam $1.78 million or 60.7 percent was for interest. The $2.93 million costs were divided three ways: Interest, 60 percent; depreciation or debt repayment, 30 percent; and only 10 percent for operation, maintenance, and administration. Here the 10 percent for operation and maintenance is the visible 10 percent of the iceberg showing above the water while the huge 90 percent of capital costs is below the surface.

6. For every 1 percent added interest rate the cost of Hungry Horse Dam or Hells Canyon Dam power would increase 24 percent. Under typical private financing of Hells Canyon Dam the price of power would increase from $19.09 per kilowatt year to about $62 per kilowatt-year, an increase of 228 percent. According to the FPC hearing the 3 small dams would produce power at somewhat over $40 per kilowatt-year or over twice the cost of Hells Canyon power.

7. The Hells Canyon is a threshold dam, a pivotal dam, (1) in terms of physical effect, (2) in terms of checking the hungry reach of private monopoly, and (3) in terms of the Hells Canyon principle.

It is the key structure in developing the 11,193,340 potential kilowatts of the Snake. This is largely a virgin river, 97 percent unharnessed. It possesses one-eighth of the Nation's future hydropower.

Surrender here means letting private monopoly take charge on the Snake. The Idaho Power Co. represents monopoly in its most alarming forms fastening its grip on schools, civic organizations, and all layers of government.

Finally the Hells Canyon principle offers positive hope of full development with 60 percent more power for at least 35 percent less cost per kilowatt-hour. It necessitates Federal construction of Hells Canyon Dam.

GUS NORWOOD.

[From Pacific Northwest Public Power Bulletin]

EXHIBIT H

FOUR TESTS FOR A REGIONAL POWER AGENCY

Gus Norwood, executive secretary, Northwest Public Power Association

(Based on talk before Portland City Club and station KOIN August 19, 1955)

I am grateful for this opportunity to discuss with you certain aspects of the proposal to create the Columbia River Development Corporation.

If the people of the Pacific Northwest could begin with a clean slate in organizing an enterprise for generating and transmitting wholesale electricity, what tests would they consider? How would they avoid the present confusion?

PRACTICALLY A CLEAN SLATE

Actually the region is much closer to a clean slate than may be realized. By the end of this century the present electric power system must be expanded at least twentyfold. The present system represents less than 5 percent of the power facilities which will be needed in 45 years. Thus we start virtually from scratch.

A young region, the Pacific Northwest has not developed the rigid institutional patterns, the airtight monopolies and hardening of the economic arteries so characteristic of European nations.

A case in point, the Bonneville Power Administration although 18 years old is a temporary agency. Section 2 of the Bonneville Act of 1937 reads, "The form of administration herein established for the Bonneville project is intended to be provisional pending the establishment of a permanent administration for Bonneville and other projects in the Columbia River Basin."

The opportunity still exists to do the job right. The opportunity still exists to write into the plan for a regional electric agency an attitude of primary responsibility to the people of the Pacific Northwest who are the electric consumers and who will work in the electrified industries yet unborn.

FOUR TESTS

This inquiry does not have to do with local retail distribution of electricity. We seek the best means for administering and financing a regional electric wholesaling agency to generate and transmit large blocks of power. The question of public, private or cooperative ownership of electric retail distribution systems remains a matter for separate, local determination.

Almost 40 percent of the people of the Pacific Northwest receive electricity from consumer-owned systems. These rural electric cooperatives, utility districts, and city distribution systems are banded together as the Northwest Public Power Association. Of 99 utility members, 67 purchase energy from the Bonneville Power Administration. Last year they paid $15 million to BPA. By 1960 they will need over $30 million worth of wholesale power per year.

For many years our utility members have been concerned because of inadequate and uncertain power supply. Thus their first test is abundant power. The obvious second test is low-test power. The third objective is comprehensive development of resources, all resources. Finally the membership desires that the people of the Pacific Northwest have an adequate voice in policymaking. This test of "regional home rule" should insure that the power agency be consumer minded.

I. ABUNDANT POWER

One of the disturbing national problems is the shortage of classrooms for schoolchildren. We have 4 million babies a year and 1,500,000 deaths or a net gain of 2,500,000 people a year. If the 5 million population of the Pacific Northwest were wiped out today, it would take the private free enterprise system of the country only 2 years to replace us.

For each 1,000 people we have about 25 babies, 10 deaths, or a net gain of 15 people. This is a 1.5-percent rate of growth. From 165 million at present our population may pass 300 million by the end of the century. The most conservative estimates say 250 million. Proportionately the Northwest, of course, grows much faster and will almost triple its population in the next 45 years.

If the school people have a problem, what about the electric power people? The school problem grows only as fast or in direct proportion to population increases. But electric demands grow much more rapidly. While population grows 1.5 percent per year electric demand rises 7.5 percent a year or 5 times as fast. From 1900 to 1950 United States population doubled but the use of electricity increased 33 times. How much power will be needed by the year 2000?

ENERGY IN THE FUTURE

In 1949 the Atomic Energy Commission employed Mr. Palmer Putnam and a large staff of experts to answer this question: What are the maximum plausible demands for energy in the next 50 to 100 years? More particularly the Commission wanted to know what would be the role of atomic power in future electric generation. Would atomic power displace hydro? In condensed form the resultant study was published in 1953 by Van Nostrand (cost $12.75) under the title "Energy in the Future." This is the magnum opus on energy, one of the significant books of our time.

Here are a few of Mr. Putnam's conclusions: In the next century man will use 18 times as much energy in all its forms as he used in the past century. Secondly, in the year 2000 about 60 percent of all energy will come from atomic sources. Thirdly, the demand for power will be so great that we will have to harness every available hydroelectric site within the limits of economic feasibility. Putnam gives no comfort to those who hope atomic power will reduce the need for hydroelectric development. Putnam drives hard that man will never quite have enough energy. His needs will be tremendous. Power demands rise geometrically.

For more specific and more conservative figures one can turn to the General Electric Co. which has been making similarly long-range forecasts. Early in 1954 Chairman Phillip D. Reed of GE in addressing the Boston Advertising Club predicted for the year 2000 an annual electric energy demand of 10 trillion kilowatt-hours. This is a twentyfold rise in the use of power.

Other General Electric executives are authority for the assertion that by the year 2000 about a third of the homes of America will be heated electrically, mostly by the heat pump. Whereas today we first convert only 3.5 percent of all energy into electricity before we use it, by the end of this century we will convert 36.5 percent of all energy into electricity. Summarizing, GE finds that the use of electricity will jump twentyfold in the next 45 years.

For the Pacific Northwest this GE rate of growth is highly conservative. It represents about 7 percent compounded whereas during 1954 the electric loads of the smaller Northwest cities increased 23.8 percent, the rural electric cooperatives experienced a 19-percent growth, and the PUD's had a 15.4-percent load growth. So the GE figures represent less than half the load growth actually exeperienced by these Northwest systems.

HUGE INVESTMENT NEEDED

Nevertheless even the conservative GE rate of load growth presents a staggering problem for the Pacific Northwest. A twenty-fold expansion of the electric systems calls for about 100 million kilowatts of generating capacity for the region or as much power as the entire Nation has today. We will need the power output of three Columbia Rivers completely harnessed. Two of those Columbia Rivers will be atomic-power sources.

Assuming an investment cost of $300 per kilowatt of generating capacity, this 100-million-kilowatt power system will require an investment for generation and transmission alone, not counting distribution facilities, of about $30 billion. If as much as one-third of this money comes from depreciation reserves and net income, we can safely conclude that the Pacific Northwest is faced with the problem of raising at least $20 billion of new power investment by the year 2000.

Initially we need about $250 million per year increasing to over a billion dollars a year toward the end of the century. Recently the Bonneville Administrator predicted a need for $7 billion of new power investment for the next 20 years alone.

As its first test the Columbia River Development Corp. must insure an abundant supply of power for all the needs of the public. This calls for raising at least $20 billion of new money in the next 45 years.

II. Low-cost Power

The progress of civilization and the very freedom of man from drudgery and economic serfdom depend on low-cost power.

THE DECLINE OF HORSES

One of the warm friendships of my boyhood was with a horse, a white, lame, and fairly old plowhorse. For anyone raised around horses, even an old plowhorse, it goes down pretty hard to have to admit that the decline of the horse is progress.

However, horses and mules are an obsolete form of energy, an expensive luxury. They keep farmers poor so that the farmer is working for the horse instead of the horse working for the farmer. Horses and mules are not low-cost power. They are parasites in the Nation's energy economy.

The gas and diesel tractor and truck started our horse and mule population down the road of technological unemployment and obsolescence. In 1915 the United States population of horses and mules reached a peak of 26.5 million. This was cut in half by 1943 to 13.2 million and by 1952 was cut in half again to 6.2 million. Currently the horse and mule population is declining by over half a million per year or about 10 percent annually. Even the Army is giving up horses.

The decline of the horse fits in with some highly significant energy statistics recently released by the Department of Agriculture which show how work is divided among animals, man, and machines.

A century ago 79 percent of the total energy used for work was supplied by animals, 15 percent by human beings, and only 6 percent by machines. By 1960 the Department estimates that animals will supply only 1 percent of our work energy, humans only 3 percent, and machines 96 percent. Thus in one century the percentage which animals occupied in our energy economy declined from 79 percent to 1 percent; the human role declined from 15 percent to 3 percent; while the role of inanimate or machine energy skyrocked from 6 percent to 96 percent.

THE DECLINE OF COAL

The great industrial complexes of Germany, England, and the Ohio Valley have been based on coal. Coal has been the standard means for heating homes. But coal has been losing before the onslaught of natural gas and oil. Mr. Putnam tells of Belgium coal mines closing down with a lot of coal still in the ground. Four thousand feet deep these mines require pumping 30 tons of water for every ton of coal removed. England is having similar experience. Under such circumstances coal is no longer a low-cost fuel. Mr. Putnam goes so far as to say that because of the ladder of rising costs probably not more than 15 percent of the coal in the earth will be removed.

DECLINE OF OIL

In the Pacific Northwest and in Tennessee an ever increasing proportion of new homes are electrically heated. When 98 percent of the new homes in Longview, Wash., are electrically heated, we no longer deal with a theory.

HEAT PUMP AHEAD

We have seen the decline of the horse. We have seen the gradual displacement of coal for heating homes by the cleaner and more convenient oil and natural gas. In certain areas we see oil in turn giving way to electric house heating. Most promising of all today is the heat pump. The heat pump will probably be the greatest electric appliance of all time and will ultimately consume more electric energy than all other appliances combined.

COST FACTORS CONTROLLING

The determining factor in selecting coal or another form of energy is cost. By watching the cost factors one can trace and ultimately predict the shift from one energy revolution to another. In coal mining the chief cost is labor. In

the Pacific Northwest the chief cost is interest on hydroelectric investment. In the examples which follow we will see the tremendous leverage of the rate of interest.

HUNGRY HORSE ICEBERG

The Hungry Horse Dam in western Montana well illustrates the impact of interest rates on power cost.

For last year the Hungry Horse operating statement showed expenditures of about $3 million. But of this total only $290,000 or 10 percent went for actual operation, maintenance and administrative cost. This 10 percent constitutes the visible costs which are apparent to the visitor at the dam.

To see what happens to the other 90 percent of costs we must go to Washington, D. C., where once a year a bookkeeper opens a ledger to record the entry for repayment of debt amounting to 30 percent and for interest 60 percent.

The operating statement of the Hungry Horse project is like an iceberg. The 10 percent of operating costs seen by the visitor at the dam is the visible part of the iceberg sticking out above the water. The remaining 90 percent, the banking transaction, lies invisible under the surface. The Hungry Horse Dam thus shows that the electric business often may involve more banking than electric business. Certainly in this operating statement we have a mixture of 90 percent banking business and only 10 percent electric business.

A 24-TO-1 LEVERAGE

What would happen if the interest rate at the Hungry Horse project were to be increased by 1 percent from the present 2½ percent rate to 3½ percent? We noted that 60 percent of the cost was interest. By dividing 2½ into 60 we obtain 24. Increasing the interest rate 1 percent raises power costs 24 percent. Here it is a leverage of 24 to 1.

Furthermore if Hungry Horse had to be constructed by a private corporation, they would need a 6-percent rate of return after payment of 52-percent corporate profits taxes or a 12-percent rate of return before the profits tax. Adding 24 percent to the price of electricity for each 1 percent rise in money cost from 2½ percent to 12 percent more than triples the cost of power and prices it completely out of the market.

The Hells Canyon project as a twin brother of Hungry Horse Dam would also experience tripled power rates under private corporate financing. Therefore neither Hells Canyon nor Hungry Horse lend themselves to private construction. They call for the lowest possible interest rate available under public financing.

The Hungry Horse iceberg amply demonstrates that low cost power depends on a low rate of interest.

DIFFERENT FROM GROCERY BUSINESS

By this same method of analysis the ratio of power cost to interest rate can be determined for the entire Columbia River power system. What would be the rise in the wholesale power rates of the Bonneville Power Administration if the rate of interest were increased 1 percent?

In seeking the answer to this question we can also note the extreme difference between the power business and almost any other business. For example, a well-organized grocery will enjoy each year about $8 of business or gross revenue from each dollar of investment. Turning now to the Bonneville Power Administration we ask what is the annual gross power revenue from each dollar of Federal power investment? It is 8 cents. The ratio is $8 to 8 cents or 100 to 1.

Out of its 8 cents the Bonneville Power Administration has paid all its costs including interest and debt repayment and still accumulated a $110 million surplus or profit. But the point of this example is that one-third of BPA costs is interest. By dividing the average interest rate of 2.6 percent into 34 percent, which is the proportion of BPA costs, we come up with this answer: For the Columbia River power system a 1 percent increase in the rate of interest would cause a 13 percent increase in power cost.

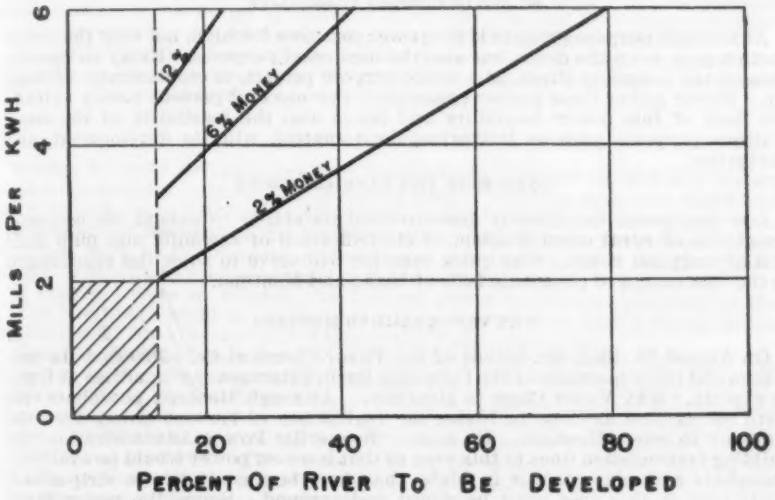
Looked at another way if the grocer and the Federal Government were both to obtain $8 of annual gross revenue, the grocer would have to invest only $1 while Uncle Sam invested $100. If the interest rate increases 1 percent, the grocer puts in an extra penny, but the Federal power system must require an additional dollar of revenue from us. Instead of collecting $8, it would require $9 or again an increase of 13 percent.

ATOMIC WILL BE LIKE HYDRO

Since most of our energy in the year 2,000 will come from atomic sources, it may be well to note that while atomic plants physically will look like steam plants, from a balance sheet and operating statement standpoint they will look more like hydro projects. According to Dr. Alvin Weinberg the cost of atomic fuel will be insignificant, about the same as paying 5 cents for a ton of coal. The heavy cost at the future atomic plants, as at present hydro projects, will be the interest on investment. Low-cost power will depend on low interest rates.

The second test which must be met by the Columbia River Development Corp. is to provide low-cost power, and therefore it must be able to enter the market and command a low rate of interest, preferably as close to 2 percent as possible.

HOW MUCH OF THE RIVER WILL BE DEVELOPED?
It depends on the Cost of Money!



III. COMPREHENSIVE DEVELOPMENT

The foregoing illustrations have related the cost of power to the interest rate. But another important relationship challenges the proposed corporation.

HOW MUCH OF THE COLUMBIA RIVER WILL WE DEVELOP?

How does the interest rate affect the economic feasibility of developing the entire 35 million kilowatt potential of the Columbia River?

This problem involves three variables and can best be illustrated by means of a graph. For the vertical axis this graph will show the cost of power in mills per kilowatt-hour, 2 mills, 4 and a ceiling of 6 mills. It will be assumed that atomic power will be competitive at this price so that energy above 6 mills is priced out of the market. For the horizontal scale we will use percentage development of the 35 million or so kilowatts of hydroelectric potential of the Columbia River expressed from 0 to 100 percent.

Today the Columbia is about 13 percent harnessed and average power cost is 2 mills. Using this as a starting point we draw a line to represent the use of 2-percent interest. As the statement of a hypothesis, this line will be drawn to intersect the 6-mill ceiling at the point where 80 percent of the Columbia River is developed. Incidentally at 82 percent the Tennessee is the most completely developed river in the United States and further projects are being planned.

Now what will be the posture of the line representing a 6-percent cost of money and finally what will be the position and slope of the line to represent a 12-percent rate of return before corporation profits taxes or 6 percent after profits taxes?

Once the 2-percent line is fixed, the position of the 6 percent and 12 percent lines is determined by using the experience ratio for the Columbia River power system, namely that each 1-percent rise in the interest rate causes a 13-percent rise in the cost of power. Thus a fairly rigid relationship exists among the three lines. If the 2-percent line should intersect the 6-mill ceiling at 90-percent or 70-percent development, then the other 2 lines would shift accordingly.

The fullest development of the Columbia's 35 million kilowatts will be achieved by the lowest possible rate of interest. Two-percent money will develop 80 percent of the river. Six-percent money will barely do 42 percent of the job. The traditional use of 12-percent money will eke out only a cream-skimming 23 percent.

The Columbia River is a man-sized job. It is no place to send a boy. To achieve comprehensive development calls for the lowest cost money available under public auspices.

MULTIPLE-PURPOSE FEASIBILITY

At multiple-purpose projects if the power cost goes too high, not only the power portion goes down the drain, but also the incidental purposes. Every navigation dam on the Columbia River, as a single-purpose project, is economically unfeasible. Power makes these projects feasible. The use of 2 percent money extends the limit of this power feasibility and hence also the feasibility of the other multiple purposes such as irrigation, flood control, wildlife development, and navigation.

UNLOCKING THE LAND RESOURCES

Low-cost power has already demonstrated its ability to extend the economic feasibility of rural electrification, of electrification of sawmills and pulp mills and of marginal mines. One quick example will serve to show the relationship to the vast untapped phosphate beds of Idaho and Montana.

WHY VICTOR CAME TO MONTANA

On August 19, 1953, Mr. Gillett of the Victor Chemical Co. addressed the governors and other members of the Columbia Basin Interagency Committee at Butte to explain, "Why Victor Came to Montana." Although Montana phosphate ores were not as good as those in Idaho, the availability of low-cost power drew the company to select Montana. He said: "Bonneville Power Administration was building transmission lines to this area so that low-cost power would be available. Phosphate rock was cheaper in Idaho than here because it can be strip-mined, while rock in this area must be mined underground. Bonneville power rates, however, were enough lower to offset this disadvantage. After careful balancing of the economic factors, rock, power, and freight rates on raw materials and finished products, the Butte area was selected, and a plant site was sought."

Here as in many other cases in the Northwest low-cost power has been the proverbial goose that laid the golden eggs.

IV. Consumer-Minded

In the Bonneville Power Administration the people of the Pacific Northwest have a good start toward achieving one of the finest power agencies in the world.

As a gilt-edge investment the Columbia River power system operates on a riskless basis since the electric consumer through his power bill absorbs all the risks and pays all the costs. Despite the security of the investment the Congress has not seen fit to provide sufficient loan funds to enable the system to operate on a public utility responsibility basis. As against a current annual need for 250 to 300 million dollars, Congress has been appropriating about $100 million.

The problem of insufficient loan funds is believed to be related to the second major criticism which Northwest people express regarding the Columbia River power system: Not only the major but even the minor decisions are being made in Washington, D. C.

How to meet these two criticisms?

REGIONAL PARTICIPATION

How can we build "regional home rule" into the proposed power corporation? Why not have the people of the Pacific Northwest write their own bill?

The first draft of the Columbia River Development Corporation bill was based on the St. Lawrence Seaway Development Corporation Act, which was signed by the President May 13, 1954. As in the St. Lawrence act, the bill provided for a single administrator. When 700 copies of this draft were mailed in August 1954 with a request for comments, some 300 suggestions came in. Practically everyone wanted a five-man board of directors.

So the second draft as mailed to some 4,000 people in October 1954, provided for a 5-man board of directors appointed by the President with the advice and consent of the Senate. Provision was also made for an advisory council, public notice on policy changes and the right of public hearing and court review as methods to insure responsiveness to the grassroots.

A special membership meeting of the Northwest Public Power Association in December left further instructions and in particular wanted provision for direct election of 1 director from each of the 4 Pacific Northwest States. This resulted in the addition of section 17 in the third draft of March 1955 whereby Congress grants consent to the States of Montana, Idaho, Oregon, and Washington to negotiate an interstate compact for the purpose of acquiring the corporation.

It may be possible for Congress, although there is some legal hesitation on this point, to provide directly in the bill for each of the four States to elect a director. This would settle the home rule problem.

CAPITAL BUDGETING

Sweden for over 20 years has very successfully operated its national budget so as to distinguish between the operating budget which is generally dependent on taxes, and the capital budget which secures most of its investment funds from the issuance of national securities. The various business or revenue-producing activities, such as the Swedish Power Board, obtain loan funds via the capital budget. These loans are then repaid together with interest.

If Congress were so minded, the Federal power investment program of the Pacific Northwest could be similarly handled. Thereby the region would obtain the full benefit from the low rate of interest on Federal securities.

Since the United States has not yet adopted a capital budget, the next best procedure is to segregate each business-type activity by calling it a Federal corporation. There are now 51 such corporations, the oldest being the Panama Canal Corporation and the most recent the St. Lawrence Seaway Development Corporation. All 51 are subject to the overall provisions of the Government Corporation Control Act of 1945. The Columbia River Development Corporation bill follows this well-established pattern except that it takes the further step of authorizing the issuance of revenue bonds in the private market.

Congress has currently under consideration a number of proposals to permit the issuance of revenue bonds for highways, school buildings, and self-financing for TVA. These bills have thus far received a cool reception because they are too favorable to the bankers. This is the danger. In all cases the revenue bonds would sell so as to require a rate of interest higher than the average cost of money to the Treasury.

The Columbia River Development Corporation bill has not been introduced in Congress. The fourth draft is now tentatively scheduled for completion in the spring of 1956. However, the TVA self-financing amendments are scheduled for further hearings starting January 9, 1956. Congressional reaction to the TVA bill will be watched with interest. If it is passed by Congress in 1956, the outlook for a Pacific Northwest bill should be favorable in the succeeding Congress.

CONCLUSION

The Columbia River Power System presents a serious banking challenge. In many respects it is more of a banking business than an electric business. A large hydroelectric system involves more banking operations than many banks face.

In the Hungry Horse "iceberg" we noted from the annual operating statement that about 10 percent of the costs went for utility operations and the other 90 percent went for financial or banking requirements.

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Low-cost power depends on low interest rates. By the year 2,000 the 4 Pacific Northwest States will require not less than $20 billion of new power investment which must be raised by the proposed Columbia River Development Corporation. Ideally this money should be available at about 2 percent interest.

The closer we come to achieving a 2 percent rate of interest the more likely we are to achieve the 4 objectives of low-cost power, abundant supply of power, a form of administration which is consumer minded, and the optimum comprehensive multiple-purpose development of water and energy resources which in turn will help to develop other regional resources to the end of more and better jobs for our people and a higher standard of living.

Your comments and suggestions will be very much appreciated.

EXHIBIT I

UNITED STATES DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Boise, Idaho.

To: Commissioner, Bureau of Reclamation.
From: Regional Director, Region 1.
Subject: Special Report—Multiple-Purpose Storage Possibilities—Clark Fork River Basin.

SUMMARY

The principal purpose of this report is to pin down those multiple-purpose storage possibilities in the Clark Fork River Basin which merit further consideration in meeting near-future storage needs. The report also contributes to an investigational responsibility assumed by the Department of the Interior in connection with the coordinated plan for development of the Columbia River Basin.

The report presents a summary analysis of storage possibilities in the Clark Fork Basin drawn largely from previous investigations, but supplemented by some additional reconnaissance studies. Prior investigations have been made by the Bureau of Reclamation, the Corps of Engineers, Geological Survey, States, power companies, and others. These studies are summarized in reports by the Bureau and the Corps.[1] In the coordinated, comprehensive plan for development of the Columbia River Basin, developed by the latter agencies and embodied in the agreement signed by the Secretaries of the Interior and the Army in April 1949, the superior storage sites singled out in the Clark Fork Basin were those known as Paradise on the Clark Fork River and Glacier View on the North Fork of Flathead River, a principal tributary of the Clark Fork.

It was recognized in the plan that storage in at least the amount available at the smaller of these two sites (Glacier View) was requisite to achieve minimum, short-term objectives for flood control and power production in the Columbia River Basin. Nevertheless, the construction of a storage dam at neither site was recommended because of strong objections to such use, in part raised by the Department of the Interior. A need was also recognized for steps leading to early development of additional storage at some point in the Columbia River Basin which will have an effect upon flood flows in the lower Columbia equivalent to that of storage at the Glacier View site. The interdepartmental agreement gave responsibility in the search for such possibilities within the Clark Fork Basin to the Department of the Interior by assigning to it investigational responsibility for all multiple-purpose storage potentialities in that drainage area, and in other, specified parts of the Columbia River Basin.

The reexamination of storage needs and storage possibilities made below, involving consideration of more than 20 sites in the Clark Fork River Basin, tends to confirm earlier conclusions. The Paradise site presents the best opportunity, all things considered, for obtaining in the Clark Fork River Basin multiple-purpose storage required for power and flood control purposes in the Columbia Basin. The Glacier View site also presents excellent possibilities. Its storage contribution to near-future needs, however, could be equaled, costs permitting, by development of a number of alternative, smaller sites, whereas, duplication of the contribution of storage development at the Paradise site is not in prospect within the basin. Although sites offering physical possibilities for storage com-

[1] The Columbia River, U. S. Department of the Interior, H. Doc. 473, 81st Cong., 2d sess., February 1950; Columbia River and Tributaries, Corps of Engineers, U. S. Army. H. Doc. 531, 81st Cong., 2d sess, Washington, March 1950.

parable in magnitude to Paradise do exist, their development would cause more serious dislocation of the existing economy.

Inasmuch as continuing economic improvements in potential reservoir sites can be expected to diminish the possibilities of storage development still further, the early resolution of problems involved in use of the Paradise site is of first importance. The program proposed involves reconsideration of the Paradise site to that end. Similar reconsideration of the Glacier View site also is proposed. Combined with the reconsideration of the latter, the proposed program entails further investigation of smaller storage possibilities of comparable effectiveness with a view to determining the feasibility of developing such sites prior to Glacier View. Storage on the Middle Fork of Flathead River with possible diversion to the South Fork is one promising possibility which will be considered.

GENERAL DESCRIPTION OF BASIN

The Clark Fork River discharges into Pend Oreille Lake, in northern Idaho. Below the lake the stream is known as the Pend Oreille River.

The drainage basin of the Clark Fork River is a mountainous, upland area of some 22,100 square miles. It lies mostly in western Montana, but includes a small area in Idaho and about 450 square miles in southeastern British Columbia, where the Flathead River rises. The Flathead is the largest tributary of the Clark Fork, contributing about half of the average annual runoff of that stream. Other large tributaries are the Bitterroot and Blackfoot Rivers.

The Clark Fork River and its tributaries drain the western slope of the Continental Divide. All or parts of several Rocky Mountain ranges—including the Mission, Swan, Cabinet, and Bitterroot Mountains—are in the drainage area. Some of the higher peaks exceed 10,000 feet above sea level in elevation, and all of the mountain ranges receive heavy winter precipitation. Thus, snowmelt provides a large proportion of the annual runoff, most of which occurs during the months of May, June, and July as discharges in excess of amounts which can be effectively utilized unless regulated by storage.

Much of the drainage basin is forested, but there also are large tracts of grazing land and some important cropland areas. These agricultural lands are located in part on high plains, but in large measure are confined to a number of broad, extensive valleys. The larger of these include the Flathead, Mission, and Bitterroot Valleys, occupying parts of the Rocky Mountain Trench, and the Missoula, Blackfoot, and Deer Lodge Valleys. Irrigated lands total about 300,000 acres, but except in the Bitterroot Valley and in the Flathead (Indian) project, they lie in small, scattered tracts.

In addition to the agricultural lands, important natural resources of the area include forests, extensive mineral deposits, vast recreational areas, and a large hydroelectric power potential.

The comparatively restricted agricultural lands, transportation facilities, towns, and other economic developments are largely concentrated in the valleys of the basin. Consequently, the development of sizable storage reservoirs is confronted at many potential sites with very serious problems of economic displacement.

NEEDS AND PROBLEMS OF COLUMBIA BASIN

Two facts of utmost importance to development of the water resources of the Columbia River as a whole must be kept in mind when thinking about multiple-purpose storage on the Clark Fork River, which is one of the Columbia's larger tributaries. These facts are (1) the need for large amounts of storage in order to get full value from the Columbia's water resources; and (2) the diminishing prospect for obtaining the needed storage because of the increasing value of developments which have been, or are being, made in the prospective storage basins.

The need springs from the fact that the natural pattern of runoff from the Columbia River Basin permits the effective use of only a small portion of the flow. The runoff is in large part the result of snowmelt and occurs as concentrated floods each spring during a period of 2 or 3 months. The floods are followed by a long season of low water during the dry autumn and continuing throughout the winter months of general freeze-up in the mountain areas. The peak flows of the flood season are commonly 10 times greater than those of the low-water season.

Protection from these floods cannot economically be provided solely by dikes, levees, and other protective measures. Storage is required to catch the floodwaters and hold them for release after the flood peak has passed.

Effective use of the power potential of the river likewise requires a large amount of storage. There is wide divergence between the demand for power and the amount of hydropower which can be produced from natural streamflows. The demand for power remains fairly constant throughout the year, but is normally highest in winter, at which time power-producing streamflow is at its low point. Thus, storage is required to hold the summer flood peaks for release for power production in the winter.

The average annual runoff of the Columbia River is in excess of 150 million acre-feet, and its power potential, due to the relative steepness of its streams, is tremendous. The full regulation of flows needed for full power development, however, would require about 500 million acre-feet of storage.

The Columbia River Basin is not lacking in sites physically suited for such storage development. The problem lies in the fact that the storage basins offering the physically most attractive possibilities have acquired, through economic development of various kinds, such high value for uses other than storage that their large-scale use for that purpose cannot now be seriously considered. It is to be expected moreover, that continuing developments in potential storage basins will further narrow the possibilities.

Complete regulation of the Columbia even through the critically low-flow years of 1929, 1930, and 1931 when the average runoff was 93 million acre-feet would require roughly 30 million acre-feet of the total required for full control of the average runoff. Development of this smaller amount of storage would require the use of a large percentage of all prospective storage sites in the United States, even on the assumption that an equal extent of storage control would be exercised in Canada, where almost half of the total flow of the Columbia originates.

A lower, initial objective for flood control and power purposes was established in connection with the main control plan for the Columbia River. The overall, immediate objective of that plan, formulated in 1948, was to provide storage capable of controlling floods like that which occurred in 1894, the greatest flood of record, to discharges of 800,000 cubic feet per second at The Dalles, Oreg. For this purpose, approximately 27 million acre-feet of storage were found necessary, distributed within the Columbia Basin as shown in the tabulation on the following page.

Storage projects—Main control plan

Site	Stream	Usable storage
		(*Acre-feet*)
Hungry Horse	South Fork, Flathead	2,980,000
Glacier View or alternate	North Fork, Flathead	3,160,000
Libby	Kootenai River	4,250,000
Grand Coulee	Columbia River	5,120,000
Priest Rapids	do	2,100,000
John Day	do	2,000,000
Hells Canyon	Snake River	3,880,000
Palisades	do	1,200,000
Boise River projects	Boise River	1,000,000
Payette River projects	Payette River	1,900,000
Total		27,590,000

STORAGE OBJECTIVES FOR THE CLARK FORK BASIN

Two of the main control plan storage projects listed are in the Clark Fork Basin: Hungry Horse and Glacier View or alternate. It was recognized in the case of the latter, however, that alternative storage equivalent in effect might be substituted in another drainage basin for the immediate purposes of the plan. The full, usable capacity of Hungry Horse Reservoir, now nearing completion, will be available in 1953. Hence, additional storage involving the Clark Fork needed for the main control plan is represented by Glacier View or alternate.

The indicated usable capacity of Glacier View (3,160,000 acre-feet), being designed to develop a relatively large amount of long-term, holdover storage, is more than enough to meet minimum needs of the main control plan. From the standpoint of flood control, about 1,800,000 acre-feet of usable capacity would

meet those requirements. A reservoir of that capacity would impound all storable flows at the site during the 3 years of low flow in the Columbia River, 1929–31, and yield roughly an average of 1 million acre-feet annually throughout that critical period for power production. Thus, additional usable capacity equivalent in effectiveness to about 1,800,000 acre-feet at the Glacier View site is needed in the Clark Fork Basin, if that basin is to play its part in the main control plan.

More complete control is urgently needed, however, particularly for power purposes, and should be sought wherever practicable. For this purpose, capacity adequate to control flows during the 3-year critical period in the Columbia River would represent a desirable minimum. For the Clark Fork Basin as a whole, the average storable flow during that period amounts to about 7,500,000 acre-feet, of which Hungry Horse Reservoir will provide control for about one-sixth of this amount. The remaining storable flow is about six times that at the Glacier View site. Development of a site need not, and in most instances should not, be limited to storage required for control during the critical period. Recognition of the desirability and need for at least that degree of control in the basin as a whole, however, provides a basis for appraising the aggregate contribution of storage possibilities in the Clerk Fork drainage area.

The average annual storable flow during the 3-year period of low flow in the Columbia River also is useful in appraising the relative importance of individual storage sites. It represents the approximate annual yield from storage adequate to control the runoff at a site during that critical period. Higher yields are obtainable, and should be sought wherever practicable, by additional holdover storage to control flows over a longer period. The fact that such increases in average annual yields over a longer period tend to be relatively small in relation to the additional storage space required, however, gives the average storable flow during the critical 3-year period particular significance for comparison of storage sites.

POTENTIAL SITES

Long search for storage sites in the Clark Fork River Basin has involved at least reconnaissance consideration of more than 100 prospective possibilities, located not only on the main stem and on major tributaries, but also on lesser tributaries, a number of which have an average runoff of less than 100,000 acre-feet annually. These numerous possibilities are located and indexed by reaches of the Clark Fork on the accompanying map (Fig. 1). Discussion of the possibilities is presented below under three categories: (1) Sites of greater promise selected as proposals for development or for further study in the coordinated plan for the Columbia River; (2) additional potentialities on tributaries for which reconnaissance studies have been made for purposes of this report; and (3) possibilities discarded as a result of preliminary studies or actions.

Coordinated plan storage site selection

In the coordinated plan for development of the Columbia River, there were recognized 17 additional possibilities for multiple-purpose storage developments in the Clark Fork River Basin. These are shown in the accompanying tabulation.

The list is made up of those sites which it was thought might be considered as potentially available for storage use and which offered relatively greater promise from an economic standpoint. The list does not include all sites at which physical conditions favor storage; a number ofsuperior sites were omitted for reasons indicated subsequently.

Potential additional multiple-purpose storage projects—Clark Fork Basin included in coordinated comprehensive plan of development for Columbia River Basin (1949)

Name	Stream	Purpose	Active capacity
			1,000 acre-feet
Paradise	Clark Fork	F, P	4,080.0
Glacier View	Flathead	F, P	3,160.0
Nine Mile Prairie	Blackfoot	F, P	960.0
Upper Joy	East Fork, Rock Creek	P, F	144.9
Sapphire	West Fork, Rock Creek	P, F	101.4
Joy	East Fork, Rock Creek	F, P	251.6
Atkins	Rock Creek	F, P	248.8
Quigley	do	P	78.1
Finlen	do	F, P	123.6
Lincoln Canyon	Blackfoot River	F, I, P	211.8
Terrill	do	F, I, P	950.0
Heinze	North Fork, Blackfoot River	I, P, F	82.8
Myrick	Clearwater River	F, P	131.5
Belton	Middle Fork, Flathead River	F, P	1,190.0
Swan Lake	Swan River	F, P	234.0
Brauer	Vermillion River	I, P	11.0
Weare	Bull River	P, F	149.0

Of the sites listed, Paradise is outstandingly the most desirable from physical and cost standpoints. The average storable flow at the site during the critical period will be approximately 4 million acre-feet with Hungry Horse in operation. The indicated usable capacity of 4,080,000 acre-feet would provide control through this period and yield about 4 million acre-feet annually. Thus, its development would more than meet the minimum additional needs indicated for the Clark Fork Basin in connection with the main control plan, and would provide control for a major part of the total storable flow of the river during the critical period. The costs at Paradise, excluding costs of strictly power features, would be approximately $47 per acre-foot of yield during the critical period, at price levels as of 1948.

Despite these favorable considerations, the authorization of Paradise has not been sought because of objections raised to its construction. A public hearing to determine attitudes on development of the project was held by the Corps of Engineers at Hot Springs, Mont., on May 26, 1948, in connection with studies for the review report on Columbia River and tributaries of 1952. Opposition to construction of Paradise substantially outweighed support for it, the reasons most frequently stated being: Displacement of residents of flooded areas; excessive flowage damage and reduction of taxable area; lack of comprehensive and integrated plan; dislocation of economy, particularly through inundation of agricultural land; violation of treaty rights with Indian tribes, some of whose lands and potential power sites would be inundated; and belief that the benefits would accrue in disproportionate share to downriver interests as opposed to the area directly affected. Investigations have been started to determine the location and extent of potentially irrigable lands in the basin. These irrigable lands will not only compensate for agricultural lands which may be inundated by storage reservoirs but will provide opportunities for additional settlement.

Next most desirable of the listed sites from physical and costs standpoints is Glacier View. The average storable flow at the site during the critical period is approximately 1 million acre-feet, about one-quarter that at Paradise. Storage development there would meet the objective of the main control plan insofar as the Clark Fork Basin is concerned, but would contribute far less than Paradise to attainment of the larger storage objective. A development of the indicated capacity at the Glacier View site would yield about 600,000 acre-feet of holdover storage annually during the critical period, in addition to the average of 1 million acre-feet available during those years, or an annual total of roughly 1,600,000 acre-feet. The cost per acre-foot for this annual yield during the critical period would be of about the same order as at Paradise, based on project cost estimates as of 1948, exclusive of strictly power features.

As in the case of Paradise, no recommendation for development of the Glacier View site has been made because of objections raised. In this instance, the flooding of lands along the western boundary of Glacier National Park, the attendant displacement of winter forage resources for wildlife, and related problems affecting wildlife populations in the park were the bases for strenuous

objection by the National Park Service and several organizations interested in preserving existing conditions there.

The Nine Mile Prairie site on Blackfoot River was considered to offer possibilities next in order below Paradise and Glacier View, among the sites listed. The 960,000 acre-feet of usable capacity contemplated at the Nine Mile Prairie site would provide for virtually full regulation of the Blackfoot River. The effective storage, gaged by the storable flow during the 1929–32 period, would, however, amount to only about one-third of the usable capacity, or roughly 350,000 acre-feet. This storable flow during the critical period is less than one-tenth that at Paradise and little more than one-third that at Glacier View. The yield from holdover storage would add about 150,000 acre-feet annually to the 350,000 acre-feet during the critical period, making a total annual yield of roughly 500,000 acre-feet during those years. Costs estimated in 1948, exclusive of strictly power features, would be about $82 per acre-foot for this critical period yield.

Storage at Nine Mile Prairie would provide less than half that required in the Clark Fork Basin for immediate purposes of the main control plan and would make relatively insignificant contributions to the larger storage objectives. Coupled with the comparatively high costs, these prospects have served in earlier plans to eliminate Nine Mile Prairie from projects considered for earlier development, but to place it high among those deserving consideration as future additions to the more promising storage possibilities represented in Paradise and Glacier View.

The 14 remaining projects on the list of potential multiple-purpose storage developments were considered in the coordinated plan to be less promising than Nine Mile Prairie. They were presented in that plan as a selection of possibilities for further study in meeting the larger, longer run storage objectives in the Clark Fork Basin.

Inasmuch as many of the 14 sites represent alternative possibilities, their total potential storage contribution is much less than the indicated active capacities would suggest. The four sites at Lincoln Canyon, Terrill, Heinze, and Myrick on the Blackfoot River and its tributary, the Clearwater, are essentially alternatives to Nine Mile Prairie, and, with the exception of Heinze, required for irrigation supply, their development would not be justified in the event Nine Mile Prairie were constructed. These four sites thus may be eliminated from consideration in taking stock of storage possibilities additional to that at Nine Mile Prairie. The Brauer site on Vermillion River may likewise be eliminated from consideration in taking stock of storage possibilities additional to that at Nine Mile Prairie; the small capacity indicated being primarily designed for irrigation purposes. With respect to the remaining sites, moreover, development of all six of those indicated on Rock Creek and tributaries would not be justifiable, inasmuch as several represent alternative possibilities for storing flows from that subbasin of the Clark Fork River.

Taking into account these duplicating aspects of the 14 sites, the average storable flow during the critical period at them, may be considered to be about 1,200,000 acre-feet. Of this, approximately 110,000 acre-feet might be stored by development of 1 or another combination of the 6 indicated sites on Rock Creek and tributaries; about 800,000 acre-feet at the Belton (upper) site on the Middle Fork of Flathead River; 234,000 acre-feet in Swan Lake [2] and 50,000 acre-feet on Bull River at the Weare site.

The total storable flows during the critical period at these sites thus exceed somewhat estimated (1 million acre-feet) storable flows at the Glacier View site. Further study may permit the selection of a combination of acceptable sites, in conjunction with Nine Mile Prairie or its alternatives, equal in degree of control to that possible at Glacier View, although development of many of the sites would unquestionably encounter strong opposition for reasons noted subsequently. Even if development could be obtained to control the critical-period storable flow at all of the sites, plus that at Nine Mile Prairie, the total involved (1,544,000 acre-feet) would be less than 40 percent of the storable flow during this period at Paradise (4 million acre-feet).

Although some combination of sites discussed above and Nine Mile Prairie might be developed which would have the same physical effect as storage at Glacier View—but far below the results possible at Paradise—the cost of developing a number of such lesser sites unquestionably would be much greater

[2] Limited to proposed active capacity. Critical period storable flows average 385,000 acre-feet.

than the cost of developing the Glacier View. Studies of the sites discussed above have not been carried to the point of cost estimates; however, as in the case of Nine Mile Prairie, where costs per acre-foot of storage yield during the critical period would be nearly double those at Glacier View, it is to be expected that the other, relatively small reservoirs would involve storage costs significantly greater than at Glacier View.

Serious problems would be involved in development of the most important of these sites, namely, Belton and Swan Lake, at which the critical period storable flows amount, jointly, to 86 percent of the total. Use of the Belton site on Middle Fork of Flathead River would involve flooding of areas within Glacier National Park of greater significance than those which would be affected by use of Glacier View, and in addition, would necessitate costly relocation of a major highway and the main line of the Great Northern Railway. In the case of Swan Lake, the adverse effect of storage development on extensive summer home and recreational use of lakeshore lands could be expected to create formidable opposition of the kind which, as noted subsequently, has precluded further development of storage in Flathead Lake.

Additional tributary storage possibilities

For purposes of this report, reconnaissance studies have been made of three additional possibilities not previously investigated. They involve the following, relatively small basins tributary to the Clark Fork River: (1) The upper basin of the Middle Fork of Flathead River; (2) Thompson River; and (3) Lolo Creek. The studies have been carried only to the point of establishing the physical availability of storage sites and the order of the storage possibilities. Foundation exploration and cost estimates have yet to be undertaken. As in the case of the other relatively small storage possibilities, it is to be expected that, even if further exploration shows the sites to be physically satisfactory, the costs per acre-foot of storage will be high in comparison with those at the Paradise and Glacier View sites.

The Spruce Park Dam and Reservoir site on Middle Fork of Flathead River is not subject to objections raised against the development of the Belton and other sites noted later in the lower part of the basin of that stream. The Spruce Park site, the best of several considered in the upper part of the basin, lies above the mouth of Bear Creek, up which the Great Northern Railway and transcontinental highway lead from the Middle Fork in crossing the Continental Divide. Use of the Spruce Park site, therefore, would not involve relocation of these facilities, and would not inundate any land in Glacier National Park. The reservoir area lies entirely within the Flathead National Forest where no man-made development would be affected.

The drainage area of approximately 365 square miles above the site has an average annual runoff of approximately 500,000 acre-feet. A dam 370 to 380 feet high would be required to impound 400,000 acre-feet. From the reservoir, a pressure tunnel 35,000 feet long could be constructed through the Flathead Range to Hungry Horse Reservoir, permitting power production in a plant at reservoir shoreline by use of Spruce Park releases through 650 feet of head, reregulation in Hungry Horse Reservoir, and additional power production at Hungry Horse and downstream plants. For comparison with other sites, the critical period storable flow at Spruce Park would be about 300,000 acre-feet.

On the Thompson River, two possible dam sites about one-half mile apart in a narrow gorge were reconnoitered. The drainage area tributary to the sites is approximately 585 square miles. From intermittent stream gagings taken during 1911–16 and from consideration of the Clark Fork runoff through the reach from Plains to Heron, it is estimated that the average annual runoff at the sites might be about 500,000 acre-feet. Storage of possibly 250,000 acre-feet of water could be obtained by a dam raising the water level 300 feet, at either site, and backing the river up some 12 miles. The lower 3½ miles of the reservoir area is in Cabinet National Forest and the remainder is in private ownership. Development now consists of a well graded graveled road paralleling the river, which serves primarily for logging purposes and for access to private cabins in the area. The critical period storable flow at either site is roughly estimated to be about 200,000 acre-feet per annum.

Lolo Creek presents limited storage potentialities at either of two possible sites located about 4 and 5½ miles, respectively, above its mouth. The drainage basin controlled in either case would be limited to about 250 square miles, but the average precipitation in the portion of the Bitterroot Mountains drained by Lolo Creek is considerably above the average for larger subbasins of the Clark Fork. A

dam raising the water surface elevation 300 feet at the lower site would create about 450,000 acre-feet of storage and provide substantially full control of this small stream. The critical period storable flow is roughly estimated at 140,000 acre-feet per annum.

Even if development of all three sites should prove economically feasible, it will be evident that they would fill a very small part of the storage needs in the Clark Fork Basin. Collectively, the storable flows at the sites on the 3 tributaries amount only to about 600,000 acre-feet per year during the critical period. Development of all three, in addition to the maximum practicable development of the smaller sites previously discussed, including Nine Mile Prairie, which appears highly improbable in view of costs and other considerations noted, would provide control of critical period storable flows (2,200,000 acre-feet) equivalent to little more than half of those controllable at the Paradise site (4 million acre-feet).

Sites eliminated

The storage possibilities presented above comprise only a small part of the dam site given consideration. The greater number of sites investigated proved less satisfactory for storage than those previously discussed, were found to hold possibilities only for run-of-river power developments; or were eliminated because of adverse physical conditions. The reasons for eliminating many of the sites from current consideration as storage possibilities lie in damages which would be suffered to existing developments, rather than unsatisfactory physical conditions.

Pend Oreille Lake.—Storage in the basin partially occupied by Pend Oreille Lake, just below the Clark Fork River Basin, has been the subject of numerous proposals in the past. Public hearings held by the Corps of Engineers in 1943 in connection with the last proposal for large-scale storage developments there led to legislative action by the State of Idaho establishing elevation 2062.5 feet as the maximum water surface elevation for the lake. The development of 1,140,000 acre-feet of active capacity in the lake below this elevation has been made by the Corps of Engineers through construction of the Albeni Falls Dam. Additional storage in the lake is not in prospect.

Main stem below Flathead River.—Storage on the main stem of Clark Fork River below the mouth of its principal tributary, the Flathead, is highly desirable because of the large volume of flow in this reach. Extensive investigations have revealed no site as satisfactory as that at Paradise. Fourteen sites have been studied, additional to that used by the existing Montana Power Co. development at Thompson Falls. These studies included an investigation by the Corps of Engineers of the possibility of joint Clark Fork-Kootenai River storage by means of dams on both streams sufficiently high to permit an interchange of flood-waters between the two streams through the relatively low Bull River-Lake Creek saddle.

Unsatisfactory foundation conditions and extensive damage from flooding ruled out of consideration all sites below the general vicinity of Paradise for purposes of a high storage dam. The only practicable development of this reach below Paradise will involve relatively low dams, essentially for run-of-river power production with small amounts of storage regulation. The sites selected as offering greatest promise for this type of development are Cabinet Gorge, recently developed by the Washington Water Power Co., Noxon Rapids, and Trout Creek, which are now being studied by the Washington Water Power Co. and the Montana Water Power Co.

Main stem above Flathead River.—Consideration of 13 sites on the Clark Fork River above the mouth of Flathead River has failed to reveal any attractive storage possibilities. Above the elevation which would be reached by the pool behind Paradise Dam, the Clark Fork is followed by two transcontinental railroads, the Milwaukee and the Northern Pacific, and a transcontinental highway. Storage could be developed by a dam of moderate height at the lower end of the Missoula Valley. This would flood out thousands of acres of irrigated lands, the two railroads, highways, and towns, and create so much damage to the economy of the Missoula Valley that, even if the fully anticipated and violent opposition to use of the site were not to develop, the cost of storage could be expected to be very high. Use of a potential site in the Hells Gate area, above Missoula, but below the mouth of Blackfoot River, would be subject to similar objection and high cost by reason of the flooding of three railroads, a power dam, a transcontinental highway, and several small towns. Use of sites on the Clark Fork above the mouth of Blackfoot River involves similar problems and, in addition, a diminishing volume of storable flow. For these reasons, the only development

on the main stem of the Clark Fork above the Flathead River believed to warrant further consideration in the near future are low, run-of-river power undertakings at the Quartz Creek and Alberton sites.

Tributaries below the Flathead River.—The tributaries of the Clark Fork below the Flathead River are of small extent and runoff, with exception of the Thompson River. Investigation of 13 sites on these tributaries has led to the selection of three as possibilities meriting further study. These previously noted, small storage possibilities are Bull River (Weare), Vermillion River (Brauer), and on Thompson River (either of two closely spaced sites). The other 10 sites investigated were eliminated from further consideration because they represent less satisfactory alternates than those selected, or are physically or economically unsatisfactory.

Flathead River below Flathead Lake.—Between the mouth of Flathead River and the existing Kerr Dam of the Montana Power Co. which regulates the elevation of Flathead Lake, seven sites have been considered. Because of poorer foundation conditions, greater cost in relation to benefits, and problems similar to those on which the objections to use of the Paradise were based, the seven sites were eliminated in favor of the greatly superior Paradise development, which would back water to the Kerr Dam and inundate the sites on the lower Flathead River. The development of sites near Kerr Dam which would provide additional storage in Flathead Lake was discarded because of objections to such use of the lake noted below.

Flathead Lake.—As in the case of Pend Oreille Lake, the possibility of obtaining a large volume of storage at comparatively low cost by use of Flathead Lake has attracted interest over a relatively long time. Storage there was recommended in a report of 1920 by the Columbia Basin Survey Commission, State of Washington, for gravity irrigation of the Columbia Basin project. Local interests around Flathead Lake and Kalispell, Mont., opposed the plan. In 1921 a review of the above report by Goethals & Co. led to concurrence with the Flathead Lake storage recommendation. A board of engineers, hired by the Bureau of Reclamation, reviewed the above reports and concurred with previous findings in February 1925.

Other proposals included that of the Cavanaugh report to the Federal Power Commission in 1925, Uses of the Upper Columbia River, which recommended the granting of storage rights in Flathead Lake to power interests, with impartial supervision of storage control. In the early 1930's a report on a comprehensive plan for development of Columbia River and tributaries for power, irrigation, and navigation was prepared by the Corps of Engineers, published as House Document 103, 73d Congress, 1st session, proposed storage development in Flathead Lake. In 1942 a Federal Power Commission report discussed development of storage in Flathead Lake by lowering of the outlet through dredging.

In 1943 the Corps of Engineers proposed, as an emergency war measure, the raising of Flathead Lake to secure needed storage for power. This proposal included a temporary raising of 3 feet and a lowering of the outlet by 6 feet to provide 1 million acre-feet of additional storage. An ultimate raising of 37 feet was also considered. This proposal met with overwhelming and violent local, State, and national opposition in a 3-day hearing in Kalispell in June 1943.

Flathead River above Flathead Lake.—The three sites on the Flathead River between the lake and the mouth of Middle Fork were eliminated from consideration for storage because of poor foundation conditions and because their storage use would entail even greater damage of the kind noted earlier in connection with the Belton site on the Middle Fork. One of the three, Coram, was selected, however, as a desirable site for a run-of-river power project.

Above the mouth of the Middle Fork, Glacier View, previously discussed, proved to be the only satisfactory storage site out of four investigated. One of the three below Glacier View, however—Canyon Creek—should be considered further as a desirable site for a run-of-river development.

Middle Fork of Flathead River.—Of four sites investigated on the Middle Fork, Belton and Spruce Park are considered to offer the better possibilities, although the previous discussion of these sites has suggested the doubtful prospects for development at Belton. The lower Belton site on the Middle Fork, below the outlet from Lake McDonald, is superior physically to the Belton site indicated as a future possibility. The lower site was eliminated as a storage potentiality because of the even greater damage which it would create. The Dryad Creek site, in the upper part of the Middle Fork Basin, was eliminated because of excessive cost.

South Fork of Flathead River.—The high degree of control over flows of the South Fork which will be exercised by the operation of Hungry Horse Reservoir has served to eliminate consideration of additional storage in the basin of that stream.

Other Flathead River Tributaries.—On the Swan River, poor foundation and reservoir conditions have served to eliminate the consideration of storage at sites below Swan Lake. The somewhat dubious prospect for storage in that lake has previously been discussed. Other tributaries of the Flathead, the principal ones being the Whitefish, Stillwater, Jocko, and Little Bitterroot Rivers, have such small storable flows, in conjunction, with problems making for very high cost, that they are known to present no significant possibilities. Reconnaissance search even for small amounts of irrigation storage on these streams has not been fruitful.

Tributaries above Flathead River.—Because of the long, narrow shape of the Bitterroot River Basin and the heavy contribution to flows made by the numerous, short, parallel streams dropping from the high Bitterroot Range on the west, the only possibilities for obtaining large amounts of storage in the basin are near the mouth of the river. Development of a prospective site there would flood thousands of acres of irrigated land in the Bitterroot Valley bottom and create such heavy damage to the economy of the valley that it has been eliminated from consideration. The numerous possibilities investigated in the upper part of the basin hold some promise for small amounts of storage. Because of the great needs for water to supplement the supplies available for lands now irrigated in the valley, however, and to irrigate new lands, the yield of such reservoirs would be predominantly used for those purposes and contribute little to storage requirements for power purposes. The previously noted Lolo Creek site may provide possibility for a small-scale development beneficial to power production.

On Blackfoot River, the investigation of 18 sites led to the elimination of 13 as offering inferior storage possibilities, first to Nine Mile Prairie, and second to the other 4 sites discussed in that basin, where storage roughly equivalent to that at Nine Mile Prairie could be obtained. One site below Nine Mile Prairie (the Bonner site) was found to merit further investigation for a run-of-river power development. Similarly, on Rock Creek, 5 of 11 sites investigated were eliminated as being inferior for storage to the 6 discussed earlier, several of which, in turn, represent alternative possibilities for further study. Flint Creek presents no significant storage possibilities additional to the existing development at Bimetallic Dam by the Montana Power Co. As in the upper Bitterroot Valley, the small-scale storage possibilities on tributaries above Flint Creek, such as the Little Blackfoot River and Racetrack Creek, will be required primarily for irrigation purposes and have insignificant power benefits.

CONCLUSIONS

1. Storage to control flows during the 3-year critical period in the Columbia River (1929–31) represents a desirable minimum objective to meet power and flood-control needs.

2. The average storable flow of the Clark Fork River during that critical period will be approximately 6,250,000 acre-feet when Hungry Horse Reservoir is in full operation. Storage capacity considerably in excess of this amount will be required for control across the critical period. No projects to provide control for any part of the 6,250,000 acre-feet are now authorized.

3. Paradise and Glacier View Dams, the 2 projects selected as most promising from more than 100 investigated, would not, in themselves alone, provide control over the average storable flow of 6,250,000 acre-feet during the critical period. That storable flow amounts roughly to 4 million acre-feet at Paradise and 1 million at Glacier View. Full control would require a large amount of additional storage, particularly in tributaries below the Paradise site.

4. No substitute for a large-scale storage development at or near the Paradise site is available. The total storable flow during the critical period at the Glacier View and Nine Mile Prairie sites and at all other nonduplicating sites recognized as storage possibilities is little more than 3 million acre-feet, or roughly only three-quarters of that at the Paradise site alone. Moreover, the average unit cost of storage at sites other than Paradise would be far greater, and proposals for its development would be attended, in many instances, with equal or greater economic displacement and objection.

5. It might be possible to develop storage at sites in the upper portion of the basin which would have an effect equal to that of Glacier View. At the sites con-

sidered, the critical period storable flows are slightly more than twice that at Glacier View. Prospective objections and prospectively high construction costs, if borne out by further investigation, could be expected, however, to eliminate development of many of the sites involved.

RECOMMENDATIONS

In view of these conclusions, it is recommended that:

1. The Paradise site be reconsidered with a view to early resolution of problems involved in use of the site and its development at the earliest practicable time.

2. The Glacier View site also be reconsidered, and that there be combined with that reconsideration the further investigation of the smaller storage possibilities with a view to determining the feasibility of their development prior to Glacier View.

H. T. NELSON.

EXHIBIT J

[From the Pacific Northwest Public Power Bulletin]

HOW BIG IS THE COLUMBIA RIVER?

(Summary of talk before engineering and operations section of Northwest Public Power Association, Wenatchee, May 10.)

The greatest challenge facing Pacific Northwest engineers is how to make the best and fullest use of our rivers.

The prophets of gloom and doom are saying we are already half done on the Columbia. Others are asking, "With atomic energy just around the corner, couldn't we keep the tributaries of the Columbia River as primitive areas?"

How big is the Columbia? What is the river worth?

My purpose tonight is to suggest that the Columbia River is worth a lot more than we have thus far been led to believe. Possibly not in our lifetime but some day the Columbia may have 50 million kilowatts of installed capacity.

RIVER OF THREE DIMENSIONS

It may be helpful to think of the Columbia River as a cube which is expanding in all three dimensions as we improve our concepts and techniques of river basin development.

The three dimensions or factors which concern us are, firstly, the amount of power, secondly, the value of power, and, thirdly, the financial feasibility. As these three dimensions expand, the cube will grow and thereby we and our children will benefit through the best and fullest development of the Columbia River.

FINANCIAL FEASIBILITY

Many a beautifully bound project report for a hydroelectric dam is gathering dust on a bookshelf because it could not meet an unreasonable feasibility test.

One such test which will affect the long-range development of the Columbia is the artificial and unrealistic assumption that the useful service life of a dam is only 50 years. This well-known ground rule has gone unchallenged until recently.

However, when the Army began to review the 308 report last fall there was included a study of a combination hydrothermal system. It was furthermore assumed that the useful service life of steam plants would be 35 years and the life of dams would be 50 years. The Northwest Public Power Association protested and urged 150 years for service life of dams.

The benefit-cost ratio of most dams doubles when 150-year service life is used, and in the case of flood-control projects may even triple. The effect of the longer life assumption will be to bring into the range of feasibility many otherwise marginal projects. Also in determining optimum dam height as at Hungry Horse Dam, the longer service life would permit the greater height or the larger reservoir.

China has a 4,000-year-old dam. Peru has one 2,000 years old. Hydraulics manuals often give 500 years or indefinite life for dams. TVA uses 100 years for depreciation purposes. Bulletin F of the Bureau of Internal Revenue permits 150-year service life for dams, waterways, and reservoirs. Recently the Bureau

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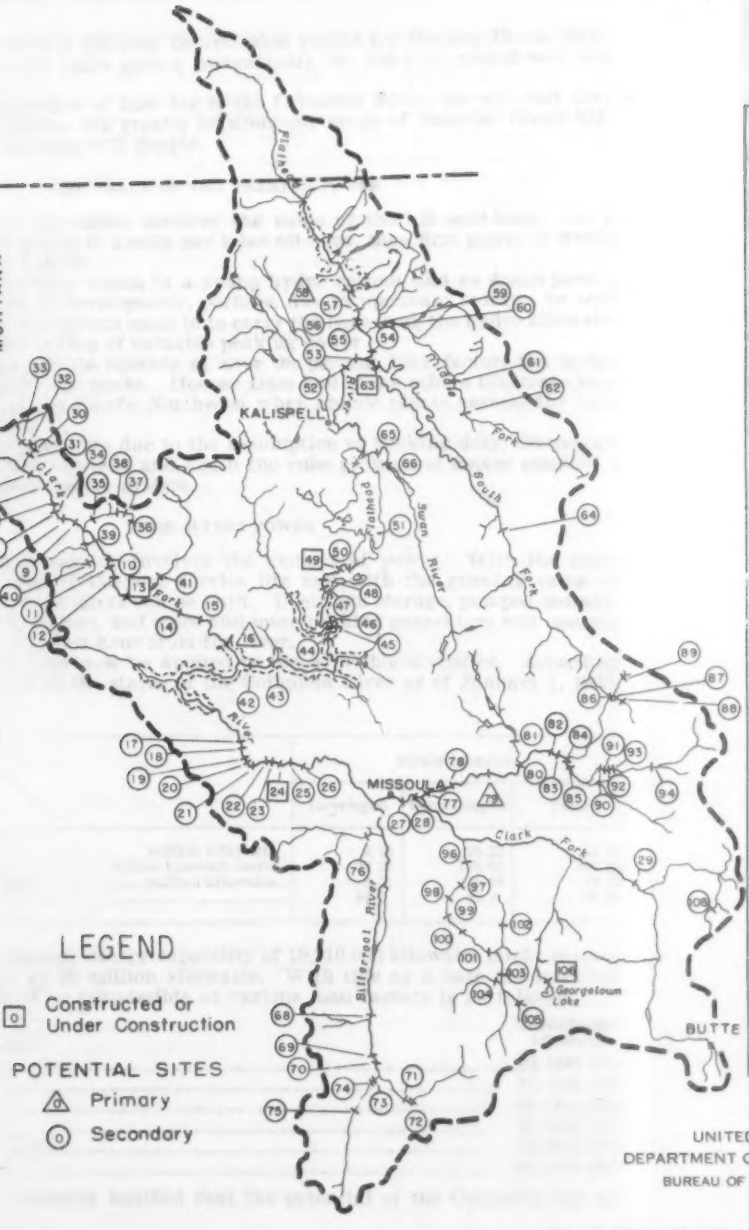

CLARK FORK RIVER BASIN

Damsites Investigated

POND ORIELLE LAKE	1
MAIN STEM BELOW FLATHEAD RIVER	
CABINET GORGE	2
HERON RAPIDS	3
CHIMNEY ROCK	4
NOXON RAPIDS	5
LOWER THOMPSON	6
UPPER THOMPSON	7
LOWER TROUT CR.	8
TROUT CREEK	9
LOWER BELKNAP	10
UPPER BELKNAP	11
DONLAN	12
THOMPSON FALLS	13
HEREFORD	14
PLAINS	15
PARADISE	16
MAIN STEM ABOVE FLATHEAD RIVER	
WHISKEY GULCH	17
QUARTZ CREEK	18
TARKIO	19
UPPER QUARTZ	20
GRACIA	21
UPPER MILWAUKEE	22
LOWER CYR	23
UPPER CYR	24
PLATEAU	25
ALBERTON	26
HELL GATE	27
MILLTOWN	28
GARRISON	29
TRIBUTARIES BELOW FLATHEAD RIVER	
(BULL RIVER)	
MEARS	30
BULL RIVER NO. 1	31
BULL RIVER NO. 2	32
BULL RIVER NO. 3	33
(GRAVE CREEK)	
GRAVE CREEK	34
(VERMILLION RIVER)	
BRAUER	35
UPPER SCREGMER	36
LOWER SCREGMER	37
HELLS DIVERSION	38
(WHITE PINE CREEK)	
BEAVER CREEK	39
WHITE PINE CR.	40
(THOMPSON RIVER)	
2 SITES	41
FLATHEAD RIVER BELO. FLATHEAD LAKE	
(MAIN STEM)	
KNOWLES	42
PERMA	43
FLATHEAD NO. 5	44
OXBOW	45
HELL	46
SHEEPSHEAD NO. 2	47
BUFFALO RAPIDS	48
BIG ARM	49
BIG ROCK	50
FLATHEAD LAKE	51
FLATHEAD RIVER ABOVE FLATHEAD LAKE	
COLUMBIA FALLS	52
BIG ROCK CANYON	53
CURAC	54
LOWER CANYON CR.	55
CANYON CREEK	56
POOL HOG HILL	57
GLACIER VIEW	58
(MIDDLE FORK)	
LOWER BENTON	59
BENTON (UPPER)	60
BRYAN CREEK	61
SPRUCE PARK	62
(SOUTH FORK)	
HUNGRY HORSE	63
MEADOW CR. RES.	64
OTHER FLATHEAD RIVER TRIBUTARIES	
SWAN RIVER	65
SWAN LAKE	66
TRIBUTARIES ABOVE FLATHEAD RIVER	
(BITTERROOT RIVER)	
LOWER BITTERROOT	67
CHARLES HEIGHTS	68
LOWER COOPER	69
UPPER COOPER	70
LOWER BULA	71
UPPER BULA	72
LOWER TRAPPER CR.	73
UPPER TRAPPER CR.	74
PICKEREL LODGE	75
LOLO CREEK	76
(BLACKFOOT RIVER)	
SOMMER	77
MONTANARA	78
NINE MILE PRAIRIE	79
CLEARWATER	80
HYDRICK	81
ORANGO B	82
CAMOODI	83
UPPER ORANGO	84
TERRELL	85
HELENE	86
MEADOW CREEK	87
LOST PONY	88
COONEY CREEK	89
LINCOLN NO. 1	90
LINCOLN NO. 2	91
LINCOLN NO. 3	92
LINCOLN NO. 4	93
LINCOLN CANYON	94
(ROCK CREEK)	
FINLEN	95
SPRING CREEK	96
QUIGLEY	97
KAMLOOPS	98
LITTLE HOGBACK	99
BIG HOGBACK	100
ATHENS	101
LONG [illegible]	102
JOY	103
SAPPHIRE	104
UPPER JOY	105
(FLINT CREEK)	
THREEFILLIC	106
(RACETRACK CREEK)	
RACETRACK CREEK	107
(LITTLE BLACKFOOT RIVER)	
LITTLE BLACKFOOT	108

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

CLARK FORK RIVER BASIN
IDAHO - MONTANA

LOCATION MAP

of Reclamation adopted a 150-year depreciation period for Hungry Horse Dam. As our experience with dams grows, undoubtedly the 150-year period will win acceptance.

In studying the question of how big is the Columbia River, we will find that using the 150-year service life greatly expands our range of financial feasibility. This dimension of our cube will double.

THE VALUE OF THE PEAKING POWER

The cube's second dimension involves the value of the kilowatt-hour. As a rough rule, if dump power is 2 mills per kilowatt-hour, then firm power is worth 4 mills and peaking 8 mills.

The same kilowatt-hour which in a young hydro system sold as dump power, may at a later stage of development, perhaps due to upstream storage, be sold as firm. Then as atomic plants come in to carry the base load, the hydro kilowatt-hour graduates to the status of valuable peaking power.

When TVA steam plants operate at over 98 percent load factor, the hydro system serves to carry the peaks. Hoover Dam and many others illustrate how hydro can be used in the Pacific Northwest when atomic plants assume the base load in 20 or 30 years.

As the value of hydro rises due to the assumption of peaking duty, the second dimension of the cube expands and again the cube grows and makes possible a bigger Columbia River power system.

MORE HYDRO POWER

The cube's third dimension involves the amount of power. With the more liberal feasibility test of 150-year service life and with the growing value of power, more and more projects can be built. Upstream storage, pumped storage, overlap, pondage, diversions, and more and more peaking generators will operate to squeeze the last kilowatt-hour from the river.

The three factors may now be applied to the available statistics. According to PFC publication P–26 the status of the Columbia River as of January 1, 1953, was as follows:

	Power (percent)		
	Developed	Undeveloped	Total
Capacity.....million kilowatts..	3.95	30.22	34.17
Average annual energy.....billion kilowatt-hours..	29.23	139.01	168.24
Energy as average kilowatts.....million kilowatts..	3.34	15.88	19.21
Load factor.....	84.5	52.2	56.2

The Columbia's average energy capability of 19,210,000 kilowatts might reasonably be rounded off at 20 million kilowatts. With this as a base the installed capacity which would be permissible at various load factors is as follows:

Load factor (percent):	*Installation kilowatts*
100	20,000,000
50	40,000,000
40	50,000,000
35	57,143,000
30	66,666,666
25	80,000,000

General Itschner recently testified that the potential of the Columbia was as follows:

	Average	Peak
	Kilowatt	*Kilowatt*
Maximum potential	19,000,000	45,000,000
Practical limit	12,500,000	28,000,000

He cited Chief Joseph and The Dalles as dams where future peaking generators would be installed.

He might have mentioned Ice Harbor as a sign toward future thinking on river development. Last year Ice Harbor Dam plans were suddenly changed from four 65,000-kilowatt to six 90,000-kilowatt units. Overnight the installed capacity was doubled from 260,000 to 540,000 kilowatts. Someday the Bonneville Dam may have a second powerhouse. Grand Coulee may have a third or even a fourth powerhouse and might even have a 43-foot extension on the dam to create added storage.

As power needs increase, as our planning technology improves and as we use the Columbia for peaking power on top of an atomic energy base load system, we should find ourselves approaching and possibly exceeding a 50-million kilowatt generator installation on the Columbia River.

GUS NORWOOD.

Senator NEUBERGER. In conclusion, I will say that the record will be kept open for the rest of the week for additional statements and supplementary material and, if you desire, to correct any of these statistics which some of us have had to give from memory.

We will stand in recess.

Thank you very much.

(Whereupon, at 11:55 a. m., the committee was recessed subject to call.)

APPENDIX

General Advisory Committee Columbia River Review Report

Conference Notes (September 20, 1955 meeting)

1. The meeting was called to order at 9 a. m. by Gen. L. H. Foote. Those in attendance were as follows:

Committee Members: Brig. General L. H. Foote, Chairman, Corps of Engineers; Lesher S. Wing, Federal Power Commission; H. T. Nelson (pro tempore), Department of the Interior; Ellis L. Hatt (pro tempore), Department of Agriculture; Tom Quast, State of Washington; John D. Davis, State of Oregon; H. T. Person, State of Wyoming; George L. Beard, private power interests; Gus Norwood, public power interests; Herbert G. West, navigation interests; and Jack D. Stevens, Pugent Sound Utilities Council.

Others present: F. S. Brown, B. E. Torpen, Roy W. Scheufele, Gordon H. Fernald, Mark L. Nelson, John D. Walker, David J. Lewis, Oliver Johnson, Howard A. Preston, Glenn H. Von Gunten, A. L. Henny and J. M. Buswell, Corps of Engineers; O. M. Browne, Bureau of Reclamation; C. E. Mohler and O. E. Demuth, Bonneville Power Administration; Melvin Burke and C. E. Remington, United States Forest Service; and Don Lane, State of Oregon.

2. General Foote opened the meeting by reading the resolution adopted July 28, 1955, by the Public Works Committee of the United States Senate requesting review of House Document 531, 81st Congress, 2d session, and other reports on Columbia River and tributaries (copy enclosed). In discussing the proposed report, General Foote brought out the following points:

(*a*) The report is to be completed in approximately 2 years.

(*b*) Report is to be realistic and factual and is to be based on sound engineering and economics.

(*c*) Report will not include the tremendous detail of House Document 531 and will be limited in scope generally to a review of the main control plan with a view to reconfirming or reestablishing this plan.

(*d*) It is hoped to include recommendations for specific projects required to meet the present and immediate foreseeable needs (next 15 to 20 years) of the region. In addition, the report will present general plans to serve as a guide for selection of projects which may be required in the more distant future.

(*e*) It is not contemplated that this report will be the final report on Columbia River Basin or that the plan presented will not require review and modification to reflect changed conditions and developments in the future.

(*f*) It is hoped that preparation of this report will not cause a delay or result in a reluctance on the part of any agency or group to proceed with its respective plans for water resource development.

3. With respect to Committee procedure and understandings, General Foote requested that the following ground rules apply:

(*a*) Suggestions and comments of the Committee members should be made insofar as practicable in assembled Committee meetings to permit them to be considered by the entire committee.

(*b*) Sound engineering and economics should govern the report studies and findings. There will be no purpose served in engaging in a discussion of social ideologies or political philosophies.

(*c*) In cases of divergence of opinion or in case a stalemate is reached on any particular item under consideration by the Committee, the Corps of Engineers necessarily will have to proceed with the study in the manner it considers most appropriate.

(*d*) Issuance of press releases regarding Committee activities should be left to the Corps of Engineers.

(*e*) Conference notes covering each Committee meeting will be prepared by the Corps of Engineers and sufficient copies circulated to each Committee member to serve his needs.

4. Mr. F. S. Brown, Corps of Engineers, discussed in some detail the study program contemplated for the review report. A copy of the study schedule is attached. This schedule is tentative and will be revised as necessary during the course of the investigation.

5. In reviewing the storage situation in Columbia River Basin, Mr. Brown brought out the following facts:

(*a*) The main control plan set forth in House Document 531 contained approximately 27 million acre-feet of usable storage. Of the above amount, approximately 21 million acre-feet were used at the various reservoirs to control the 1894 flood to a flow of 800,000 cubic feet per second at The Dalles. This is equivalent to an effective storage at The Dalles of 17,300,000 acre-feet.

(*b*) The present status of reservoir projects of the main control plan is as follows:

(1) Glacier View: Not recommended because of opposition by recreation and wildlife interests.

(2) Libby: Authorized but construction delayed pending completion of negotiations with Canada.

(3) Priest Rapids: Plan proposed by Public Utility District No. 2 of Grant County would provide only 500,000 acre-feet in lieu of 2,100,000 acre-feet contemplated in the main control plan.

(4) John Day: Appears that 500,000 acre-feet in lieu of 2 million acre-feet is about the maximum amount that can be obtained.

(5) Hells Canyon: Brownlee and Pleasant Valley would provide about 1,500,000 acre-feet as compared to 2,600,000 used in the main control plan in controlling the 1894 flood.

(*c*) The above changes reduce the total usable storage in the system from approximately 27 million acre-feet to 13,500,000 acre-feet, of which 9,500,000 acre-feet would be effective at The Dalles. This amount of storage would be sufficient to reduce the 1894 flood at The Dalles to a flow of 920,000 cubic feet per second as compared to 800,000 cubic feet per second under the main control plan.

(*d*) In view of the above, it is apparent that the Corps of Engineers is faced with the problem of obtaining additional storage for flood control or raising and strengthening the levee system along lower Columbia River. The Clearwater River projects (Bruces Eddy and Penny Cliffs) would provide 3,700,000 acre-feet of storage, which would be 100 percent effective in controlling the 1894 flood at The Dalles. Other possibilities which will be investigated in the present review study include:

(1) Canadian storage: Indeterminate amount.
(2) Storage on Clark Fork River: 4 million±acre-feet.
(3) Springston-Coeur d'Alene River: 2 million±acre-feet.
(4) Similkameen-Similkameen River: 1,600,000±acre-feet.
(5) Yaak and Moyie-Kootenai Basin: 400,000 to 500,000 acre-feet.
(6) Spruce Park-Middle Fork Flathead River: Unknown.
(7) Ninemile Prairie-Blackfoot River: 1 million±acre-feet.
(8) Kettle River: 500,000 to 900,000 acre-feet.
(9) In addition it may be necessary to investigate numerous smaller storages.

6. Mr. Brown also briefly outlined the system power studies which would be made in connection with the review study. These studies will take into account the effect of thermal power in the system. The system studies are designed to determine the value of the various projects over their economic life under various possible sequences of development. To implement this intent, a number of sequences will be studied. Succeeding levels in any sequence would be developed by the addition of hydro and steam to the preceding level until the steam base in the system is so large as to assure ultimate operational procedure for the hydro portion of the system. The first sequence would bring in the maximum amount of storage and succeeding sequences would include progressively lesser amounts of storage. Power studies were discussed in more detail later in the meeting by Mark L. Nelson. The attached paper entitled "Ground Rules for System Analysis" covers the discussion by Mr. Nelson.

7. Mr. Brown also discussed regulation for flood control which would be provided by storage in the various sequences of development.

The attached tabulation entitled "Flood Control Storage" illustrates the storages available and the degree of control which could be exercised over the 1894

flood at The Dalles for sequences I through V. Preliminary routing studies indicate sequence IV would provide approximately the same degree of flood control as the main control plan set forth in House Document 531. The two attached hydrographs illustrate schematically the accomplishment of each project of the main control plan and sequence IV in controlling the 1894 flood.

8. Mr. Wing, Federal Power Commission, reviewed the procedure to be followed by his office in estimating load growth. Important points brought out by Mr. Wing were as follows:

(*a*) Bonneville Power Administration will furnish the estimate of heavy industrial load growth and will cooperate in other load growth studies.

(*b*) Load growth studies are important from the standpoint that they fix the time a project or group of projects are or will be needed to meet a load.

(*c*) Forecasted load figures will be large and may be shocking to a good many people even though computed on a conservative basis.

(*d*) In making the load forecasts, consideration will be given to the following factors:

(1) Population trend of the United States and the region.

(2) Amount of natural resources in the region, the probable rate of development and the labor force required for development.

(3) Industrial possibilities in the area.

(4) Past load growth in area.

(5) Load factors and diversity.

(6) Effect of natural gas being brought into the area.

(7) Limited remaining amount of low-cost power.

(*e*) The load growth estimates will be based on normal trends. Estimates will be checked by all available means.

(*f*) Load growth in the next 10 years may be as rapid but probably not any more rapid than during the past 10 years.

(*g*) Short-term estimates (to be met by utilities) may be as much as 30 percent greater than long-term estimates.

9. Mr. Demuth, Bonneville Power Administration, outlined briefly the procedures to be followed in estimating transmission costs. Salient points of his discussion were as follows:

(*a*) Transmission systems will be studied for each generation scheme.

(*b*) Costs will be estimated for the major transmission grid to principal load areas for each transmission system studied. Subarea loads to be served will be furnished by the Federal Power Commission in collaboration with Bonneville Power Administration.

(*c*) Considerable work has already been accomplished in studies made in collaboration with the Pacific Northwest Power Co., Puget Sound Utilities Council, and Public Utility District No. 2 of Grant County. In connection with these and other studies, a transmission grid involving 10,000 miles of line to serve a regional load of 24,000 megawatts has been worked out and the costs computed. This work will serve as a basis and starting point for the review studies.

(*d*) Preliminary cost figures will be available by mid-January 1956.

10. Mr. Gordon H. Fernald, Corps of Engineers, outlined the various studies being conducted by Canada for development of its portion of Columbia Basin. At present these studies fall into three broad categories:

(*a*) Development of head of Columbia River in Canada.

(*b*) Diversion of Kootenay River flows into the Columbia.

(*c*) Diversion of Columbia River flows (and Kootenay flows) into the Fraser.

As yet little data are available on the results of these studies. It is anticipated however that they will be completed by late 1956 and data should be available by early 1957. In the event these studies are not available for inclusion in the review report, alternative storage plans will have to be evaluated. All contact with Canada regarding these studies will be through International Joint Commission channels.

11. Mr. H. T. Nelson, Bureau of Reclamation, indicated that all agencies of the Department of the Interior would cooperate to the maximum extent possible in the review study. Since Interior's program has already been planned for this fiscal year without provisions for assisting in the Columbia River review study, its main contribution may come next fiscal year. Interior agencies, however, will review their current programs with a view to rearranging them as much as possible. Studies and investigations currently underway or contemplated by the Bureau of Reclamation include—

(*a*) Irrigation depletions.

(*b*) Burns Creek: Reregulating reservoir for Palisades.

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(*c*) Alpine: Approximately 1 million acre-feet upstream from Palisades.

(*d*) Duncan Ferry: Reservoir on Owyhee River upstream from Owyhee Reservoir.

(*e*) Clark Fork Basin: Ninemile Prairie and Spruce Park sites are currently being investigated. Other upstream storage sites will be investigated. The Bureau does not contemplate that any further study will be given to Glacier View or Paradise.

(*f*) Increasing height of Grand Coulee Dam.

(*g*) Ways and means of providing financial aid to irrigation.

12. Mr. Nelson indicated that studies on the third powerhouse at Grand Coulee and use of outlets at Grand Coulee for flood control were complete.

13. An interesting fact cited by Mr. Nelson was that return flows from the Columbia Basin project would amount to 1,700,000 acre-feet of which about 1 million acre-feet would be during the storage-control period.

14. Mark L. Nelson, Corps of Engineers, outlined system power studies to be made in connection with the review report. The attached paper referred to in paragraph 6 above covers these studies in detail.

15. John D. Walker, Corps of Engineers, discussed navigation benefit studies completed to date and further studies required in connection with the review report. The attached paper entitled "Navigation" covers the remarks of Mr. Walker.

16. Mr. Glenn H. Von Gunten, Corps of Engineers, discussed in some detail the effect of river regulation on navigation. While it is recognized that peaking operations will create large fluctuations in river flows it is not expected that detailed studies will show that these fluctuations will be of such magnitude as to interfere seriously with navigation. The attached paper entitled "River Regulation Studies" covers the discussion by Mr. Von Gunten.

17. Mr. Ellis Hatt, Soil Conservation Service, indicated that the Department of Agriculture would designate a representative to the General Advisory Committee and would participate in the meetings. The Department of Agriculture is interested in the review study from the following standpoints:

(*a*) Impact of reservoirs on national forests.

(*b*) Provision of recreation facilities at reservoirs on national-forest lands.

(*c*) Flood-forecasting procedures.

(*d*) Soil-conservation and land-management practices.

18. General Foote indicated that the initial public hearings, originally scheduled for November 1955, probably would be postponed until February 1956. This procedure would allow time to firm up the nature, scope, and definition of the review and permit the presentation of more definite and detailed data to local interests.

19. Mr. John D. Davis, State of Oregon, expressed the view that we should get our problems before the public. In that way the public would be thoroughly aware of the situation and would be in a position to assist in working out a satisfactory solution.

20. There were no suggested additions to the scope of studies outlined.

21. Several questions were raised relative to the projects tentatively selected for groups A and B. Suggestions for further consideration included additional projects substantially firmed up for construction by the utilities and inclusion of alternate studies covering alternative plans for development of various stretches of river.

22. The next meeting of the General Advisory Committee was tentatively scheduled for January 1956. Tentatively, items for the agenda at that meeting will include:

(*a*) Review of progess to date.

(*b*) Preliminary examination of projects and projects proposed for further study.

(*c*) Power benefits and values.

(*d*) Studies and interests of the Department of Agriculture.

(*e*) Studies and interests of the Public Health Service.

(*f*) Use of actual service life versus economic life of projects in evaluating project economics.

COMMITTEE RESOLUTION, UNITED STATES SENATE COMMITTEE ON PUBLIC WORKS

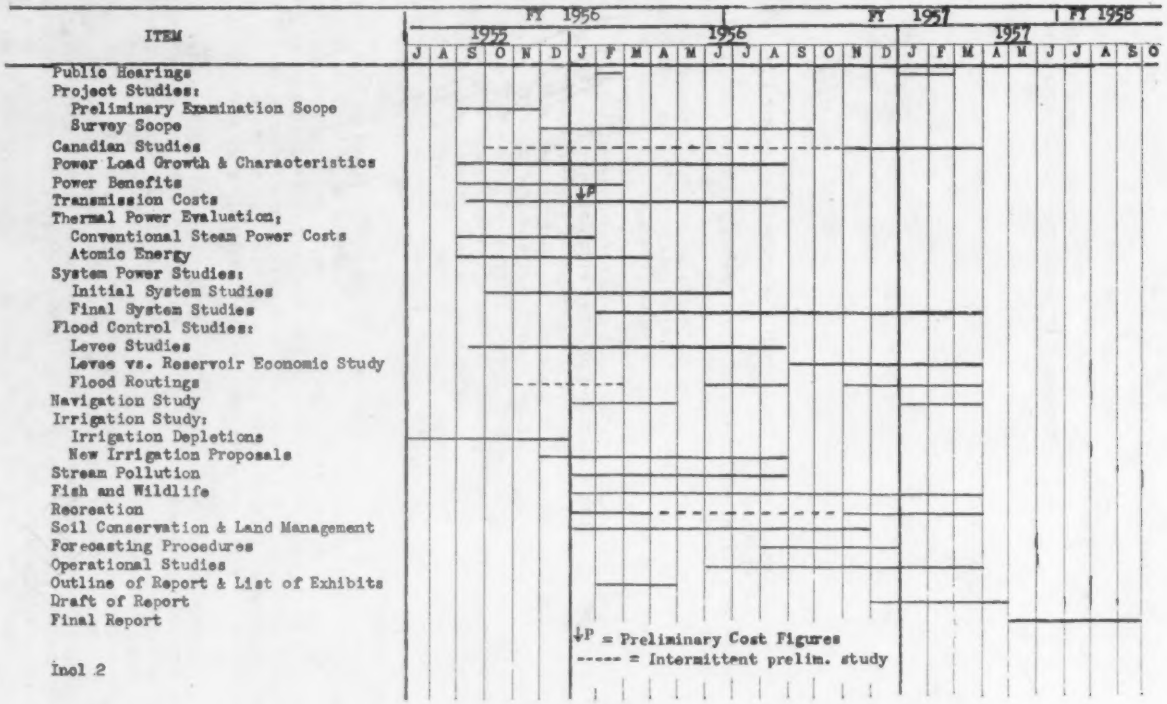
(84th Cong., 1st sess.)

Resolved by the Committee on Public Works of the United States Senate, That the Board of Engineers for Rivers and Harbors, created under section 3 of the

SCHEDULE OF REPORT STUDIES

COLUMBIA RIVER REVIEW REPORT

23 Sept 1955



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River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report on the Columbia River and tributaries published as House Document Numbered 531, Eighty-first Congress, second session, and other reports, with a view to determining the advisability of modifying the existing project in any way at this time particularly with regard to present requirements of flood control including consideration of flood storage in Canada; the present needs of navigation; a restudy of hydroelectric power potentialities as part of a combined hydro-thermal system; and consideration of all related water uses.

Adopted July 28, 1955.

DENNIS CHAVEZ, *Chairman.*

(Requested by Senator Henry Dworshak, of Idaho.)

GROUND RULES FOR SYSTEM ANALYSIS

Since the submission of the review report on Columbia River in 1948 a number of changes have taken place in the basin which requires a reappraisal of the situation not only from the flood-control aspect but also from the power point of view. In House Document 531 the power systems analyzed were studied on an all-hydro basis. It is apparent that systems involving a large amount of thermal electric generation and even nuclear power will be needed in the future if the expected load growth is to be met. Under these conditions the combined hydro and thermal system will have much different operating characteristics than an all-hydro system. The transition from the all-hydro to the combined operation no doubt will be gradual. The system characteristics must be analyzed at several levels or periods throughout the project's economic life if the overall project value or benefit is to be determined.

As has been stated earlier, to evaluate a project's value or benefit it is proposed to analyze six different sequences of development at different levels and conditions of development throughout a 50-year period. The system studies will be made primarily to determine the value of the various projects over their economic life and rather than starting with fixed assumptions, it is intended to explore the different periods of development under various possible orders of development. To implement this intent system growth sequences will be studied. Each sequence is developed by adding a storage project or combination of storage projects to a system common to all sequences and consisting of projects now existing or under construction plus the group A projects. Succeeding levels in any sequence are developed by the addition of hydro or hydro and steam to the preceding level until the steam base in the system is so large as to assure ultimate operational procedure for the hydro portion of the system. The various levels of each sequence will be selected to meet equal loads or in other words to meet the load in the same year as the corresponding level in all other sequences. The sequences will vary from an optimistic picture insofar as storage is concerned to a pessimistic one where storage is a minimum and run-of-river development is a maximum.

The various system power routing studies will be based on flow data for the period July 1928 through June 1948 unless it can be established by further study that the use of median year flows or some period, including not more than 5 or 10 more years more nearly representing the long-range average-flow conditions, is more satisfactory for the systems with large amounts of steam. This latter possibility bears further study before a decision can be reached. In the event median flows prove satisfactory, consideration will be given to uisng a longer range median.

It is proposed to use the published flow data of the United States Geological Survey and modification of the flows as determined by the water management subcommittee of the CBIAC. The subcommittee is now engaged in working out the flows for ultimate conditions and this work will be completed shortly. A decision as to the flows to be used for initial conditions has not been arrived at yet. In the event the 1948 conditions are used to reflect the initial conditions, no added work is necessary. To make the report and studies more nearly indicative of the 1960 initial condition a substantial amount of work would be required for a minor refinement of the power studies. Flows for intermediate levels of depletion to match the systems being studied would be determined by interpolation or some modification of this method.

The most critical part of the power studies is to establish the system operating rules and the final procedures can be established only after completion of some preliminary studies. Generally it may be said, however, that the operation will be on a forecasted runoff basis, the systems will be operated to a shaped load,

and the storage use pattern will be varied as the relation of storage, steam, and downstream installation in the system varies.

The operation during the refill period will be based on some realistic method of forecasting so as not to use the storage so ineffectually as is necessary when no forecast is used or to such an impossibly high degree of effectiveness as results from using hindsight operation.

In the predominantly hydro systems, rule curves will be used to protect firm power loads during the storage draft period but storage releases will be made only to the extent necessary to meet firm and estimated salable secondary loads when reservoirs are above the rule curve.

In any system with a large amount of steam, no more storage will be withdrawn than is necessary to utilize the total annual flow most efficiently with the projects and installations in that system.

The estimated magnitude and shape of loads at the various levels of development will be provided by the Federal Power Commission who will coordinate their studies with Bonneville Power Administration and the Corps of Engineers and utilize industrial load data prepared by Bonneville Power Administration.

In the systems used to meet the loads prior to about 1975 the operation will be tailored to prime and secondary requirements, then there will be a transition period during which the operation may be neither exclusively for the maximum prime nor the maximum energy and the length of this period will vary with the rate at which steam is added. In the final systems in each sequence the operation will aim at producing the most possible energy consistent with the other requirements of the projects at that time.

Storage and pondage use studies will be made considering both economic limits of capacity development and the limitations which may be imposed on peaking by other water-use requirements. Only one sequence will be used for this study. Steam will be added in increments to a point where further additions will have no effect on hydro installations. These studies will be made with alternate limits of peaking at the run-of-river projects to establish the overall effect of these limitations.

In the transition of the system over the years from a predominant hydro to a predominant thermal the operation of the plants will change considerably. Initially the hydro is on the base with a relatively high load factor operation but ultimately the thermal plants will be on the base with the hydro plants carrying the peaking at a low load factor. This concept requires that individual plants to be built in the future must be carefully studied to insure that adequate provisions are incorporated in the project layout to permit ultimate installation of all capacity which is less costly than steam.

GROUP A PROJECTS

(Considered for Early Construction)

Noxon Rapids
Wells
Rocky Reach
Priest Rapids
Brownlee
Oxbow
Hells Canyon (low)
Pleasant Valley
Hills Creek
Cougar
Mountain Sheep
Penny Cliffs
Bruces Eddy
Lower Granite
Little Goose
Lower Monumental
Ice Harbor
John Day
Mossyrock

GROUP B PROJECTS

(Additional Projects for Consideration for Early Construction)

Glacier View
Ninemile Prairie
Quinn
Buffalo Rapids 1, 2, 4
Roza
Upper and Lower Scriver
Garden Valley
Green Peter
White Bridge
Copper Creek
Upper Baker
Paradise
China Gardens
Asotin
Clarkston

GROUP C PROJECTS

(Remaining Possible Projects To Be Considered as Feasible)

Kootenai Falls
Long Meadow
Katka
Spruce Park and Tunnel
Palisades (reregulated)
Swift (Devils Backbone)
Quartz Creek
Similkameen
Springston
Chiwawa
Wenatchee

CANADIAN STORAGE

Mica Creek
Arrow Lakes
Libby

SEQUENCES OF DEVELOPMENT

Sequence I

1960: Existing and under construction.
1970: 1960 resources plus group A projects plus Paradise or alternate Clark Fork storage and Glacier View plus necessary additional United States run-of-river projects.
1975: 1970 resources plus Canadian storage (including Libby) plus remaining United States run-of-river projects and, if necessary, additional storage.
1985: 1975 resources plus all remaining United States hydro projects plus necessary steam.
2000: 1985 resources plus additional steam.

Sequence II

1960: Existing and under construction.
1970: 1960 resources plus group A projects plus Paradise or alternate storage plus necessary United States run-of-river projects.
1975: 1970 resources plus Canadian storage and if necessary additional United States run-of-river projects.
1985: 1975 resources plus all remaining United States hydro projects plus steam.
2000: 1985 resources plus added steam.

Sequence III (year control sequence)

1960: Existing and under construction.
1970: 1960 resources plus group A projects plus Canadian storage.
1975: 1970 resources plus all United States run-of-river projects.
1985: 1975 resources plus steam.
2000: 1985 resources plus additional steam.

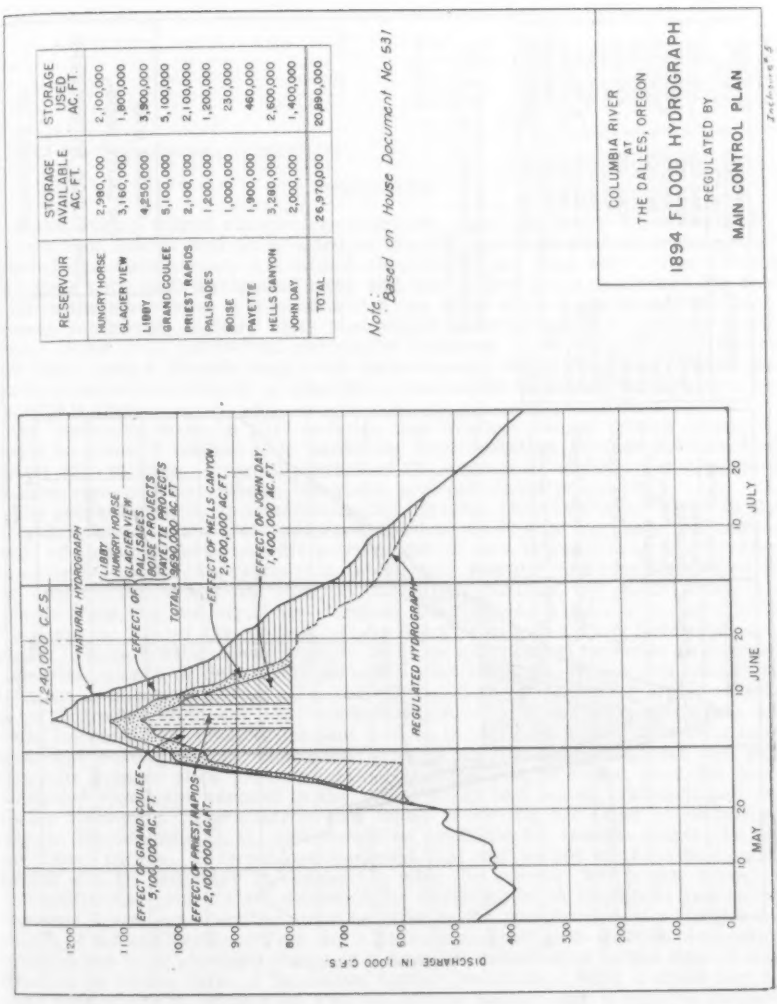
Sequence IV

1960: Existing and under construction.
1970: 1960 resources plus group A projects plus Paradise or alternate storage plus necessary United States run-of-river projects.
1975: 1970 resources plus all remaining United States run-of-river projects plus necessary steam.
1985: 1975 resources plus additional steam.
2000: 1985 resources plus additional steam.

Sequence V

1960: Existing and under construction.
1970: 1960 resources plus group A projects plus group B run-of-river projects plus steam if necessary.
1975: 1970 resources plus all United States run-of-river projects plus necessary steam.
1985: 1975 resources plus added steam.
2000: 1985 resources plus added steam.

Sequences II, III, and IV are subject to the earlier addition of steam if studies indicate it desirable.



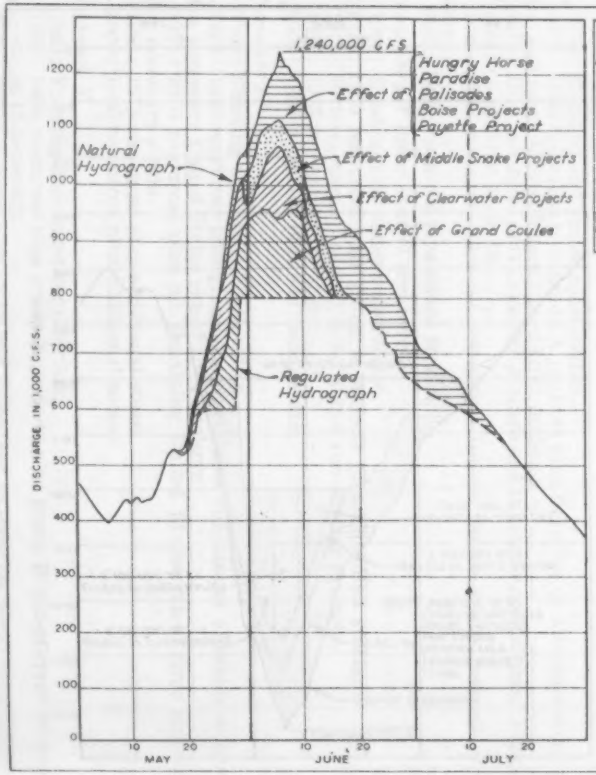
RESERVOIR	STORAGE AVAILABLE AC. FT.	STORAGE USED AC. FT.
HUNGRY HORSE	2,980,000	2,100,000
GLACIER VIEW	3,160,000	1,800,000
LIBBY	4,250,000	3,900,000
GRAND COULEE	5,100,000	5,100,000
PRIEST RAPIDS	2,100,000	2,100,000
PALISADES	1,200,000	1,200,000
BOISE	1,000,000	230,000
PAYETTE	1,900,000	460,000
HELLS CANYON	3,280,000	2,600,000
JOHN DAY	2,000,000	1,400,000
TOTAL	26,970,000	20,890,000

Note: Based on House Document No 531

COLUMBIA RIVER AT THE DALLES, OREGON

1894 FLOOD HYDROGRAPH

REGULATED BY MAIN CONTROL PLAN



RESERVOIR	STORAGE AVAILABLE AC. FT.	STORAGE USED AC. FT.
Hungry Horse	2,980,000	2,100,000
Paradise	4,080,000	4,080,000
Grand Coulee	5,300,000	5,300,000
Priest Rapids	500,000	500,000 *
Palisades	1,200,000	1,200,000
Boise	1,000,000	230,000
Payette	650,000	160,000
Middle Snake	1,500,000	1,500,000
Penny Cliffs	2,300,000	2,300,000
Bruces Eddy	1,430,000	1,430,000
John Day	500,000	500,000 *
Total	21,464,000	19,300,000

* *Factor-of-safety storage, not actually used but considered necessary for positive flood control.*

COLUMBIA RIVER
AT
THE DALLES, OREGON

1894 FLOOD HYDROGRAPH

REGULATED BY

SEQUENCE IV

Flood-control storage

Sequence	Storage available 1,000,000 acre-feet	Regulation during 1894 flood		
		Used 1,000,000 acre-feet	Effective at The Dalles 1,000,000 acre-feet	Maximum flow at The Dalles, cubic feet per second
I	47.6	39.0	31.1	620,000
II	44.4	37.2	30.1	630,000
III	33.8	28.9	23.8	710,000
IV	21.4	19.3	17.4	800,000
V	16.0	13.9	13.1	870,000

NOTE.—Based on preliminary routing studies.

NAVIGATION

A plan for an inland slackwater navigation route extending from Bonneville to Lewiston, Idaho, was culminated in the 308 report of 1948 with the recommended and subsequently authorized the Dalles and John Day Dams. These two dams with their navigation locks and slack-water pools comprised the final links in the slackwater system of which the other units were Bonneville Dam, already completed, McNary Dam then under construction and the four lower Snake Dams with authorized navigation features. Also recommended in the 308 report was a 30-mile open river improvement above Lewiston, Idaho, primarily to permit movement of otherwise inaccessible limestone and ore reserves out of this area.

Our estimates made in 1948 indicate that average annual system commerce would be about 5 million tons producing transportation savings estimated at almost $7½ million. Over 85 percent of the estimated tonnage was comprised of three commodities: Wheat, limestone, and petroleum products.

The general growth and industrial development that has taken place in the Columbia Basin since 1948 indicated that an up-to-date appraisal should be made of the navigation benefits attributable to this inland navigation system. In connection with this reanalysis, which only recently has been completed in the field offices, it was felt that, to the extent possible, we should take into consideration the industrial development that can be expected to occur over the economic life of the system. Ivan Bloch, the well-known industrial consultant here in Portland, was hired to make an appraisal of probable anticipated industrial growth which might logically contribute to prospective waterway tonnages. As we now reappraise the situation, the future river traffic will be more diversified than our 1948 studies indicated and we have taken into account movement of commodities that will be induced by future industrial locations and developments. Our total tonnage and savings estimates are substantially greater than previous estimates. We feel, however, that the more farsighted viewpoint adopted in the recent study is a sound approach and not unduly optimistic. The study is now under review by the Chief of Engineers' office in Washington, D. C., and should be available for release within the not too distant future. It is not contemplated that any review of these navigation studies will be necessary in connection with the current 308 review report.

As additional projects are proposed for development in the upper reaches of Columbia River, consideration must be given to the justification of a further extension of the navigation system and a decision reached as to whether navigation facilities are to be provided either as a complete installation at the time of construction or in the form of minimum facility provision. Such a study has already been made in connection with the Priest Rapids and Wanapum projects and considered of additional projects in the reach of Columbia River between Rock Island and Chief Joseph Dams will require a similar study. Likewise, consideration must be given to the previously recommended but not yet authorized open river improvement upstream from Lewiston, Idaho. An alternative plan of development for this reach of the river would consist of a series of low dams with navigation locks. The current report also will give consideration to the economic feasibility of modifying the locks at Bonneville Dam.

RIVER REGULATIONS STUDIES

As briefly outlined by Mr. Walker the primary purpose of the navigation-benefit study recently completed was to reevaluate navigation benefits relating to the Columbia River slackwater system above Bonneville Dam. The navigation improvements were assumed to be completed by 1975, in conjunction with power development and to be in operation at that time. The system would provide slackwater on Columbia River terminating in McNary Pool, slackwater development on Snake River to Lewiston, Idaho, and improved open channel navigation from Lewiston upstream to Lime Point, Idaho. It is significant that of the total tonnage above The Dalles, nearly one-half of the tonnage and two-thirds of the benefits are generated on Snake River above Ice Harbor Dam. Similarly, 15 percent of the total tonnage above The Dalles originates above Lewiston, Idaho. From these values it is readily seen that Snake River navigation above Lewiston is an important factor in the economics of the Columbia-Snake River navigation system. The plan considered for development of Snake River above Lewiston provided for a 6 by 150 foot channel. In House Document 531, it was envisioned that ultimately slackwater development up to the mouth of Salmon River would be achieved. Due to the large volume of tonnage expected to originate on Snake River above Lewiston, it would appear that study from an operational standpoint to fully investigate the practicability of moving over 1 million tons annually through a 6 by 150 foot channel with relative high velocities should be made in comparison to movement of the tonnage over a slackwater development. Open river navigation would probably preclude utilization of slackwater equipment operating downstream from Lewiston and necessitate considerable terminal and transfer facilities at Lewiston.

Barge traffic on Columbia River is now carried by barges of 500 to 1,000 ton capacity. These barges at present are limited to 44 feet in width by the Dalles Celilo Canal and limited generally 6 to 8 feet in draft. The length is usually 150 to 200 feet. The barges are handled by diesel-powered tugboats ranging from 1,500 to 4,500 horsepower for open river operation. Such tugboats can handle from 3 to 6 barges upstream to The Dalles and on McNary Pool. However, they are limited to 1 barge through the Dalles Celilo Canal, and 1 or 2 barges on the open river depending on flow conditions. The Dalles Celilo Canal is now a major obstacle to barge movement that not only control the size of barges and their loads but causes considerable delay in movement and is a hazard to operations. Upon completion of the Dalles Dam but prior to completion of John Day, it is expected that operators will begin to operate with much larger equipment. Standard barges of 3,000- to 5,000-ton capacity requiring 12- to 14-foot water depths will be able to go to Pasco whenever the Columbia River flow exceeds 280,000 cubic feet per second at The Dalles (perhaps 3 to 4 months of the year). At lower flows tugboats of present design will handle 2 to 4 such barges to the head of The Dalles Pool and 1 to 2 upstream to McNary Dam. Some of the same barges will operate in coastal trade to California, Prget Sound, and Alaska. When the waterway is completed fully loaded barges drawing 14 feet of water are expected to move to Pasco during all seasons of the year. The running time upbound from Portland to Pasco with a 1,800 horsepower boat and a single petroleum barge is now about 40 hours (12 hours running time between Portland and The Dalles, and 5 hours between McNary and Pasco may be accomplished with a 300-horsepower boat). The downstream passage is presently about 27 hours between Pasco and Portland. Upon completion of slackwater, river running time with a 3-barge tow and 3,600-horsepower boat between Portland and Pasco will be approximately 32 hours.

Upon completion of presently proposed slackwater navigation system between Portland, Oreg., and Lewiston, Idaho, channel depths will in general be controlling at the locks and the channel velocities controlling immediately downstream thereof. The depths over the lock sills varies from 24 feet at Bonneville to a minimum of 15 feet on the Columbia River projects and 14 feet on Snake River projects. Although minimum channel depths of 12 feet are provided on Columbia River reaches and 9 feet minimum proposed on Snake River below Lewiston, normally depths in excess of 16 feet will be available on Columbia River and in excess of 12 feet on Snake River. In reference to channel velocities below the locks, the conditions will be most critical under flood season flows. The velocities immediately downstream from the multiple-purpose projects during low flow periods will be appreciably affected by peaking of the powerplants. However, peaking operations will not control since velocities under flood-flow condi-

tions for an appreciable period of time each year will be much more critical than flow conditions under power-peaking operations.

For a distance of about 1 mile downstream from the lower end of the Bonneville lock, along Hamilton Island where the river is constricted to a width of 800 feet, natural current velocities range from 3.5 miles per hour at minimum flow to about 8.5 miles per hour at a flow of 400,000 second-feet. The latter flow is exceeded only about 45 days per year on an average. At 800,000 second-feet, the velocity would be about 12 miles per hour. This reach, through which four-barge tows can be handled without difficulty, except at high stages, will be a controlling factor insofar as towboat power and size of ascending tows are concerned, and may present some difficulty in future ship navigation.

On Lower Snake River mean velocities will not be in excess of 3.3 miles per hour for mean daily flows up to but not in excess of 50,000 second-feet, which are expected to occur 26 percent of the time under initial conditions and 8 percent of the time under ultimate conditions. Peaking operations may increase the frequency to 20 percent of the time under ultimate conditions. This situation is comparable to a critical stretch on the Columbia River at Hamilton Rapids, below Bonneville Dam, where a mean velocity of 3 miles per hour is equaled or exceeded 37 percent of the time:

The following illustrates navigation channel velocities at critical locations upon completion of the Columbia River slackwater development and main control plan storages:

Flow at The Dalles	Controlling location	Average velocity in miles per hour	Percent of time velocity is exceeded
100,000	Hamilton Island, mile 143	2.9	100
125,000	do	3.3	52
200,000	do	3.8	17
300,000	do	4.3	12
400,000	do	4.6	7
500,000	Sheridan Point, mile 148	4.9	4
600,000	do	5.9	2
800,000	do	7.7	0

For flows in excess of 400,000 cubic feet per second velocities also will be nearly as critical at Umatilla below McNary Dam based on 255 operating pool at John Day.

On Snake River similar conditions will be realized with the most critical velocities downstream from lower Monumental for flows under 200,000 cubic feet per second and downstream from lower Granite for greater flows. The controlling velocities are as follows for various flow conditions:

Columbia flow	Snake flow	Velocity in miles per hour
115,000	20,000	2.1
260,000	50,000	3.3
500,000	100,000	4.3
650,000	200,000	5.4
800,000	285,000	7.2

In reference to the peaking operations on Columbia River the flow may be varied from about 40,000 cubic feet per second to 200,000 cubic feet per second under phase C operation conditions which in general will result in fluctuations of tailwater of 4 to 5 feet at McNary, John Day, and The Dalles. With ultimate installations, the flows to these dams may fluctuate from 40,000 cubic feet per second to 300,000 cubic feet per second with a resulting change in tailwater from 8 to 10 feet. At Bonneville Dam, a fluctuation of flow from 40,000 cubic feet per second to 138,000 cubic feet per second results in a 10-foot rise in tailwater. It may be reasonably expected that the tailwater fluctuation summarized above may be realized in a period of 2 to 3 hours of time.

Lower Snake River flow variations under phase C conditions may be expected to vary from 10,000 cubic feet per second to 45,000 cubic feet per second

with associated tailwater changes of 2 to 4 feet. With ultimate installations the flow variations are expected to be approximately 10,000 cubic feet per second to 90,000 cubic feet per second with associated tailwater fluctuations of 7 to 8 feet. Again these changes are expected to take place in a period of 2 or 3 hours during critical periods of power peaking.

Although the above indicates a rapid change the duration of the change is short and extreme variations will be realized only immediately downstream from the dams.

Studies are presently being made of the flow conditions below Ice Harbor in conjunction with design of the navigation lock approach channel and a study of pondage operations for peaking of McNary and Ice Harbor projects.

The pondage operational studies due to the coordination of all lower Columbia and Snake River projects operating to meet a system load are essential to determination of the number of units and pondage drawdown that should be provided. These studies will also provide detail information on flow conditions that may be expected downstream from each project to evaluate the effect of power peaking operations on navigation. In such an analysis, especially in reference to Snake River, it would appear advisable to review slackwater navigation requirements from an operational viewpoint to determine if the basic concept of floating equipment and operational plans is at present the same as at the time the House Document 531 studies were made.

GENERAL ADVISORY COMMITTEE, COLUMBIA RIVER REVIEW REPORT

Conference notes (January 17, 1956, meeting)

1. The meeting was held in the conference room of the North Pacific division office on January 17, 1956. Those in attendance were as follows:

Committee members: Brig. Gen. L. H. Foote, chairman, Corps of Engineers; Lesher S. Wing, Federal Power Commission; Arthur M. Piper, Department of the Interior; Ellis L. Hatt, Department of Agriculture; Tom Quast, State of Washington; John D. Davis, State of Oregon; Mark R. Kulp, State of Idaho; L. A. Colby, State of Montana; Earl Lloyd (alternate for H. T. Person), State of Wyoming; Gus Norwood, public power; A. E. Alspaugh (alternate for G. L. Beard), private power; Jack D. Stevens, Puget Sound Utilities Council; and Herbert G. West, navigation.

Others present: O. M. Browne, Bureau of Reclamation; Allan Meadowcroft and R. S. Goodridge, Federal Power Commission; J. T. Barnaby, Fish and Wildlife Service; Robert L. McGrath, Public Health Service; and F. S. Brown, B. E. Torpen, G. H. Fernald, Mark L. Nelson, Roy W. Scheufele, Oliver Johnson, David J. Lewis, John D. Walker, A. L. Henny, G. B. Hunt, and G. H. Von Gunten, Corps of Engineers.

The meeting was opened by General Foote who briefly reviewed progress to date on the review study as follows:

(*a*) The Seattle and Walla Walla districts are making preliminary studies and appraisals of a large number of projects. Studies will show many of these projects to be infeasible or impracticable because of foundation conditions, high costs, objections by local interests, or other reasons. These unfavorable projects will be discarded. More detailed studies and appraisals will be made of the remaining favorable projects. The frank and sincere comments of the Committee members were requested with respect to the acceptability of the projects under study.

(*b*) Power studies accomplished to date have been of an exploratory nature to determine the best method of planning and operating hydro projects in a combined hydro-thermal system.

(*c*) General Foote stressed the importance of the fish and wildlife resource in the Columbia River Basin and announced that an Advisory Committee on Fish and Wildlife had been established. This Committee, composed of representatives of the State fish and game agencies and the United States Fish and Wildlife Service held its first meeting on January 10, 1956. It is hoped that studies of this group will fully evaluate the effects of water-resource projects, beneficial as well as adverse, on the fish and wildlife resource.

(*d*) A four-man consulting board composed of prominent, nationally known engineers is being established primarily to review and advise on Columbia River power studies and the power aspects of the investigation. (Subsequent to the meeting date, approval was received to establish the board with membership

as follows: Hibbert Hill, Northern States Power Co.; Walter L. Huber, Huber & Knapik; Samuel B. Morris, consulting engineer; and Calvin V. Davis, Harza Engineering Co.)

(*e*) An informal meeting has been held with local officials at LaGrande for the purpose of reviewing and discussing water-resource problems in the Grande Ronde Basin and possible acceptable solutions to these problems. A similar meeting is planned to be held in Spokane with Coeur d-Alene mining interests regarding possible adverse effects of water-resource development on mines and mining properties in the Spokane River Basin. Other informal meetings may be held with local interests in other subbasins prior to the holding of formal public hearings.

(*f*) The initial public hearings originally scheduled for February 1956 probably won't be held until April or May of this year. This delay is necessary to permit the districts to complete preliminary appraisals of projects, advancement of power studies, and further appraisals by our advisory committees and consultants before presenting the first proposals to the public.

(*g*) Very little additional information is available regarding plans for development of the water resources in the Canadian portion of the basin. Although it is known that the Federal Government of Canada is making intensive studies, no joint Canada-United States studies are currently in progress by the International Columbia River Engineering Committee. It is essential that firm data on Canadian proposals be obtained in the relatively near future in order that the effects on United States projects can be properly evaluated.

(*h*) Because of insufficient funds, industrial load surveys and industrial load growth forecasts being made by the Bonneville Power Administration will be based on a limited review and extension of available data from the 1948 report.

(*i*) It may be proper to consider some of the serious problems of the Willamette River Basin in the Columbia River review study. Desirable additional improvements would consist of (1) increased channel capacity below certain reservoirs, (2) additional storage projects on McKenzie and South Santiam Rivers, and (3) increasing the height of Fern Ridge Dam to provide additional flood-control storage capacity. This matter has been referred to higher authority and a decision is expected in the near future.

3. Mr. Wing, Federal Power Commission, reviewed progress to date on studies of forecast load growth, power values, and load shapes. He emphasized that studies to date were preliminary in nature and undoubtedly would be revised as more detailed studies were completed. Revised prelimintary estimates of peak and energy requirements through the year 2000 and 1980 load shapes were forwarded to the Corps of Engineers by letter of December 21, 1955. (See enclosure 1). Independent population estimates by FPC and BPA are in close agreement and mutually satisfactory values have been agreed upon. Division of industrial loads to be estimated by BPA and other loads to be estimated by FPC have been agreed upon. Tables showing past power requirements by subareas and by classification are nearing completion. Estimates of potential future energy requirements of farm, residential, and commercial customers are in progress. With respect to power values, considerable data have been obtained on Washington coal reserves and probable cost and estimates of future fuel costs for Seattle, Portland, Pasco, and Spokane have been made. Studies of future fuel costs in western Montana and southern Idaho are underway. Work also is underway on tabulating past load data by months, obtaining typical load shapes for each subarea, adjusting for load growth, and modifying for anticipated changes in characteristics.

4. Committee comments on load growth included a reference to estimates prepared by the General Electric Co. indicating our power load in year 2000 will be over 100 million kilowatts as compared to 67 million kilowatts estimated by Federal Power Commission. Although it was generally considered that the higher figure was optimistic and involved salesmanship, it was agreed that the General Electric Co. studies should be considered. It was noted also that population forecasts by others are optimistic. The abundant water supply may be a strong factor in the industrial expansion of the Pacific Northwest. In view of possible divergent estimates with respect to magnitude of loads in the relatively distant future, it may be desirable to develop upper and lower limits of estimated loads to be served.

5. Mr. Lewis, Corps of Engineers, reviewed power studies to date. These studies have been devoted to critical periods with 1975, 1985, and the year 2000 loads, assuming sequence IV projects (21,400,000 acre-feet of storage) in opera-

tion. These preliminary studies of the critical period conditions indicate that it probably will be economical to continue to operate upstream storage projects primarily for the development of maximum prime power until a very substantial amount of thermal power has been added to the system.

6. Oliver Johnson, Corps of Engineers, discussed the relationship of flood control and power and the characteristics of floods in the Columbia Basin. There is little conflict between flood control and power on the main stem and major tributaries east of the Cascades. Comparative data regarding the 1894 and 1948 floods at key stations are summarized below:

	1894 flood (percent contributed to flows in excess of 800,000 cubic feet per second at The Dalles)	1948 flood (percent contributed to flows in excess of 700,000 cubic feet per second at The Dalles)
Columbia River below Arrow Lakes	18.8	17.7
Kootenai River at Libby	10.5	8.1
Clark Fork River at Albeni Falls	15.0	16.8
Columbia River at Priest Rapids	68.7	68.0
Snake River at Hells Canyon	9.0	4.9
Salmon River at Whitebird	7.6	8.4
Clearwater River at Spalding	7.7	10.5
Snake River at Clarkston	26.4	26.3

7. Gordon Fernald, Corps of Engineers, discussed briefly the projects being investigated by the Seattle and Walla Walla districts and the Bureau of Reclamation. He pointed out that the studies would be made in three phases. In the first phase, all known possible projects were considered and those determined to be obviously impractical or infeasible were discarded. In the second phase studies currently underway, the potential projects remaining are to be investigated in sufficient detail to permit a preliminary appraisal and the discarding of those additional projects found to be infeasible. The third phase will consist of detailed surveys and appraisals of the remaining projects. It is not anticipated that run-of-river power projects will be carried much beyond the second phase studies. A list of projects discussed by Mr. Fernald is attached as enclosures 2 and 3.

8. With respect to the Smoky Range project, Mr. Brown stated a brief report would be submitted to the Chief of Engineers who in turn would submit it to the Secretary of the Interior for an administrative decision as to whether or not the project should be given further consideration.

9. Comments of the committee members regarding certain projects were as follows:

(*a*) *Smoky Range.*—There will be objections from recreation and wildlife interests if any national park lands are inundated. Local objections may not be extensive.

(*b*) *Priest Lake.*—The State of Idaho would object to regulation of Priest Lake by an agency other than the State. Any sizable fluctuation in lake levels would depreciate values of lake shore properties by a substantial amount.

(*c*) *Swan Lake.*—No serious objection provided no change is made in lake levels. Development along river below lake is not extensive.

(*d*) *Ninemile Prairie.*—The project appears to be reasonably free of objections.

(*e*) *Yaak and Moyie Rivers.*—No insurmountable problems known.

(*f*) *Rock Creek.*—Rock Creek is one of the three major trout streams of the State of Montana. The downstream project outlined by Mr. Fernald is definitely out. The upstream storage project may be far enough upstream to permit its consideration. There may be serious objections to this project, however.

(*g*) *Springston.*—May be more serious objection to this project now than there was at the time the project was being considered in connection with House Document 531.

(*h*) *Middle Fork Flathead.*—No serious objections known regarding development at this time.

(*i*) *Garden Valley and Horseshoe Bend.*—Some objection by local people because of dislocations that would result from either project. The people in the Garden Valley Reservoir area, however, are pretty much resigned to the fact now because that project has been proposed for some time. There is always some

objection to transporting Payette River water to the Mountain Home irrigation project.

(*j*) *Thousand Springs.*—Extent of objections will be dependent upon amount of land inundated in the Hagerman Valley area.

(*k*) *Boundary.*—Would raise objections from mining interests.

10. Mr. Fernald discussed the type of project economic analysis to be used in the review study. Salient points of his discussion are summarized below.

(*a*) An economic life of 50 years will be used in computing annual benefits and costs for economic analysis of projects.

(*b*) Where benefits are known to vary over the economic life of the project, the present worth method of analysis will be used to determine the equivalent average annual benefit. This method gives consideration to the time periods at which benefits are realized and places all values on a common time basis. Thus, benefits which will accrue at more distant periods are discounted relative to the more immediately accruing benefits of the earlier years.

11. There was considerable discussion regarding the validity of using a 50-year economic life for hydro projects when the actual service life is much longer. In the case of steam plants, the actual service life of 30 to 35 years is used in economic analyses. It was suggested that in a comparison of hydro versus steam, hydro developments would be placed at a disadvantage unless their full service life were considered in the analysis.

12. Mr. Barnaby, United States Fish and Wildlife Service reported on the first meeting of the newly formed Advisory Committee on Fish and Wildlife held on January 10, 1956. He announced that all members of the Committee had indicated they would cooperate in the studies regarding the effects of water resource development projects on fish and wildlife and that the Fish and Wildlife Service will act as coordinator in getting the views of the State representatives assembled. At the next meeting of the Advisory Committee on Fish and Wildlife, tentatively scheduled for February 29, 1956, a preliminary report will be submitted for review by the Corps of Engineers.

13. Article IX of the Columbia River interstate compact contains specific language with respect to the consideration to be given to recreation and fish and wildlife resources in water resource development planning. It was suggested that the Corps of Engineers give consideration to this article of the compact in formulating its projects.

14. It was agreed that the next meeting of the General Advisory Committee should be held prior to the holding of formal public hearings, probably in late March or early April.

FEDERAL POWER COMMISSION (SAN FRANCISCO REGIONAL OFFICE) NOTES RE POWER REQUIREMENTS ESTIMATE

The past requirements and preliminary estimates of future requirements of the Pacific Northwest are shown on the wall chart. Also shown for comparison purposes are past and estimated future requirements for the United States. The Pacific Northwest estimates shown were submitted to the Corps of Engineers with our letter of October 12, 1955. Some slight revisions have been made since that time—see our letter to the Corps of Engineers, dated December 21, 1955, copy attached—but the changes would not be noticeable on the chart.

The estimates were based primarily on projection of trends of past requirements modified by consideration of the following factors:

1. The heavy industrial loads are not expected to increase as rapidly in the future as in the past 15 years.

2. The rate of increase in residential and commercial use per customer is expected to decline. The advent of natural gas will also tend to reduce the rate of increase.

3. Additions to the region's supply will be made at increasing costs, and after about 1975 or 1980 additional energy production will be almost entirely from fuel-electric plants at costs substantially higher than existing hydro plants.

4. The foregoing factors will tend to reduce the rate of consumption increase per capita. However, such factors as growing population, dynamic economy, heat pump possibilities, growth of light industry, etc., will tend to some extent to offset these adverse effects.

On the basis of the foregoing factors, we have tentatively estimated the future requirements to be as shown on the chart. The compound annual increases for 5-year periods are estimated to be approximately as follows:

	Percent		Percent
1930–40	4.30	1970–75	5.30
1940–50	15.00	1975–80	5.05
1950–55	9.85	1980–85	4.24
1930–55	9.55	1985–90	4.24
1955–60	7.15	1990–95	3.20
1960–65	6.42	1995–2000	3.20
1965–70	5.55		

It is of interest to note that in 1985 (20 years hence) the annual load increase will be over 1 million average kilowatts—about 1,500,000 kilowatts must be added each year.

By 1990 there will be over 15 million average kilowatts generated annually from fuel plants of the 30 million total Pacific Northwest requirements. If it is assumed that coal is used as the primary fuel, some 60 million tons would be required for that year's generation. Actually it is probable that a large portion of the fuel requirements at that time will be of the nuclear type.

These estimates, as previously stated, are preliminary. Final estimates will be based on the detailed studies which are now underway.

Progress made on the study since the preliminary estimates were prepared are shown on the attached progress report.

The general procedures to be followed were discussed before the group on September 29, 1955, and are reported in item 8 of the notes on that meeting.

FEDERAL POWER COMMISSION,
San Francisco, Calif., December 21, 1955.

Brig. Gen. L. H. FOOTE,
Division Engineer, North Pacific Division,
Corps of Engineers, United States Army,
Portland, Oreg.

DEAR GENERAL FOOTE: Reference is made to our letter of October 12, 1955, with which we transmitted preliminary load estimates through the year 2000 and load-shape estimates for the year 1980–81.

In further study of these data we have found that some slight adjustments in the estimated requirements and the load shape are desirable in order to obtain consistency with other years. Although the changes are relatively small and would probably not affect the work you are doing, we are sending you the revised data in order that we may all be on the same basis. It is probable of course that the final estimates will differ by greater amounts.

The enclosed table also shows the estimates on a fiscal-year basis, July to June, since it appears that such information will be useful to you.

Very truly yours,

LESHER S. WING,
Regional Engineer.
By IRVINE J. REES,
Acting.

TABLE No. 1.—*Pacific Northwest preliminary estimates of power requirements, 1955–2010*

ANNUAL ENERGY—AVERAGE MEGAWATTS

Year	CBIAC study area [1]		Pacific Northwest,[3] calendar year	Year	CBIAC study area [1]		Pacific Northwest,[3] calendar year
	Calendar year	Fiscal year [2]			Calendar year	Fiscal year [2]	
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1955	4,760	4,600	4,890	1985	24,200	23,770	24,800
1960	6,730	6,500	6,900	1990	29,500	28,940	30,250
1965	9,180	8,900	9,400	1995	35,100	34,430	36,000
1970	12,010	11,710	12,300	2000	40,900	40,300	42,000
1975	15,530	15,140	15,900	2005	47,000	46,380	48,300
1980	19,830	19,350	20,300	2010	53,000	52,350	54,500
PEAK DEMAND—MEGAWATTS [4]							
1955	6,950	6,520	7,190	1985	38,000	37,000	39,130
1960	10,030	9,490	10,310	1990	46,600	45,400	48,010
1965	13,870	13,220	14,300	1995	55,800	54,300	57,540
1970	18,390	17,660	18,930	2000	65,400	64,100	67,500
1975	24,000	23,110	24,700	2005	75,500	74,100	78,000
1980	31,000	29,800	31,780	2010	85,500	83,900	88,000

[1] Area as defined in FPC memorandum July 27, 1955, CBIAC—Power Planning Subcommittee.
[2] Fiscal year ending June 30 of year designated.
[3] Washington, Oregon, Montana west of Continental Divide, Idaho, except that served by Utah Power & Light Co.
[4] Calendar peaks are in December, whereas fiscal-year peaks are in January.

TABLE No. 2.—*Preliminary estimate of 1979–80 monthly peak and energy requirements in percent of annual Pacific Northwest*

Month	Average monthly energy as percent of annual average	Monthly maximum demand as percent of annual peak	Monthly and annual load factors (percent)
(1)	(2)	(3)	(4)
July	92.16	84.53	70.8
August	94.97	86.00	71.7
September	96.28	88.69	70.5
October	99.06	93.30	68.9
November	102.51	97.52	68.3
December	104.84	99.06	68.7
January	107.04	100.00	69.5
February	106.76	96.59	71.8
March	102.68	92.79	71.9
April	99.39	89.60	72.0
May	97.31	88.72	71.2
June	96.71	87.56	71.7

Summary of storage and head possibilities, Columbia River review report

No.	Site	Possible developments			
		Storage projects		Run-of-river projects	
		Feasible	Being investigated	Feasible	Being investigated
	CLARK FORK BASIN	*Acre-feet*	*Acre-feet*	*Head (feet)*	*Head (feet)*
3	Boundary, mile 17, Pend Oreille River			170	
4	Mile 35, Priest River			70	
5	Mile 215, Clark Fork				55
7	Quinn Springs, mile 248, Clark Fork				100
8	Mile 281, Clark Fork				90
9	Quartz Creek, mile 301, Clark Fork			131	
10	Mile 315–317, Clark Fork				55
12	Mile 35–41, Flathead River		400,000		(1)
13	Buffalo Rapids No. 2, mile 61, Flathead River			(2)	
14	Little Bitterroot (near mouth)		60,000		
15	Flathead Lake outlet, mile 73 Flathead River		500,000		
16	Swan Lake, Swan River		600,000		
17	Depew, Stillwater River		120,000		
18	Coram, mile 153, Flathead River			107	
19	Smoky Range, mile 167, Flathead River	1,500,000			
20	Spruce Park, mile 50, Middle Fork, Flathead River		400,000		
22	Lolo Creek		100,000		
24	Bonner, mile 2.5, Blackfoot River				150
25	McNamara, mile 13, Blackfoot River				114
26	Ninemile, mile 22, Blackfoot River	600,000			
27	Ovando, mile 47, Blackfoot River		154,000		
28	Quigley, mile 14.5, Rock Creek				200
29	Atkins, mile 42.7, Rock Creek		120,000		
30	Thompson River		250,000		
	Subtotal	2,100,000	2,704,000	478	764
	KOOTENAI RIVER BASIN				
31	Libby, mile 217.0, Kootenai River	5,010,000			
32	Mile 204.9, Kootenai River			55	
33	Kootenai Falls, mile 189–191, Kootenai River			150	
34	Katka, mile 157–163, Kootenai River			90	
35	Long Meadows, mile 28, Yaak River		450,000		
36	Yaak Falls, mile 9, Yaak River				210
37	Yaak Canyon, mile 5, Yaak River				(3)
38	Meadow Creek, mile 11, Moyie River		300,000		
39	Eileen, mile 6, Moyie River				150
40	Moyie Springs, mile 1, Moyie River				90
	Subtotal	5,010,000	750,000	295	450
	SPOKANE RIVER BASIN				
42	Bowl and Pitcher, mile 64, Spokane River				90
43	Springston, mile 3.5, Coeur d'Alene River	2,595,000			
44	Enaville, mile 37, Coeur d'Alene River	(4)			
45	Leland Glen, mile 55, Coeur d'Alene River	307,000			
46	Teddy Creek, mile 76, Coeur d'Alene River		(5)		
47	Mile 59 to 65, St. Joe River		200,000		
	Subtotal	2,902,000	200,000		90
	KETTLE RIVER BASIN				
49	Curlew, mile 64, Kettle River		150,000		
	OKANOGAN RIVER BASIN				
51	Nighthawk, mile 14, Similkameen River		50,000		
	WENATCHEE RIVER BASIN				
52	Wenatchee and Chiwawa Rivers	150,000		475	
	COLUMBIA RIVER, MAIN STEM				
55	Wells, mile 516			61	
56	Rocky Reach, mile 475			86	
	Subtotal			147	
	Grand total	10,162,000	3,854,000	1,395	1,304

[1] A run-of-river plant for 55 feet of head will be studied if storage project is infeasible.
[2] Montana Power Co. will apply to FPC within a year for license for run-of-river plant for 85 feet of head. This project would be drowned out by storage development at mile 35–41 on Flathead River.
[3] Site being studied by Northern Lights, Inc. No information is available.
[4] Enaville with 601,000 acre-feet of usable storage is alternate to Springston project.
[5] Teddy Creek will be included if Leland Glen is eliminated.

Columbia River review report—Summary of storage and head possibilities

Site	River mile	Possible developments			
		Storage projects		Run-of-river projects	
		Feasible	Investigate	Feasible	Investigate
		1,000 acre-feet	*1,000 acre-feet*	*Head (feet)*	*Head (feet)*
Snake River:					
Clarkston	141			40	
Asotin	151			100	
China Gardens	176			95	
Nez Perce	186		3,650		
Mountain Sheep	193.5			165	
Pleasant Valley	214	500			
Hells Canyon (low)	250			208	
Oxbow				117	
Brownlee		1,000			
Marsing	426		975		
Guffey	445.5				103
Thousand Springs	585		950		
Clearwater River:					
Lapwai	3				35
Myrtle	16				66
Agatha	27				53
Peck (reregulate)	36				35
Greer	52				100
Kooskia (reregulate)	55				55
Penny Cliffs	78	2,300			
Bruces Eddy, North Fork	2	1,433			
12 additional sites, inventory only			4,000		
Grande Ronde River:					
Narrows	3		1,000		
Troy	40		500		
Rondowa	78		660		
Upper Grande Ronde			155		
Salmon River:					
Freedom	70		285		
Crevice	100		1,480		
9 additional sites, inventory only			4,300		
Payette River:					
Horseshoe Bend	50		1,000		
Garden Valley	70	1,250			
Cascade, North Fork	42	650			
Owyhee River:					
Owyhee	27	715			
Duncan Ferry	113		700		

GENERAL ADVISORY COMMITTEE, COLUMBIA RIVER REVIEW REPORT

Conference notes March 20, 1956, meeting

1. The meeting was held in the North Pacific Division office in Portland, Oreg. Those in attendance were as follows:

Committee members: I. J. Rees (alternate for Mr. Wing), Federal Power Commission; Arthur M. Piper, Department of the Interior; Ellis L. Hatt, Department of Agriculture; Tom Quast, State of Washington; John D. Davis, State of Oregon; Mark R. Kulp, State of Idaho; L. A. Colby, State of Montana; H. T. Person, State of Wyoming; George L. Beard, private power; Gus Norwood, public power; Jack D. Stevens, Puget Sound Utilities Council; Herbert G. West, navigation; and Gen. L. H. Foote, Corps of Engineers.

Others present: Boyd Austin, Bureau of Reclamation; Allan Meadowcroft, Federal Power Commission; and F. S. Brown, C. H. Giroux, Roy Scheufele, Gordon H. Fernald, Mark L. Nelson, John Walker, David J. Lewis, Noble A. Bosley, Raymond F. Bracelin, G. B. Hunt, Glenn H. Von Guten, Arnold L. Henry, and Howard Preston, Corps of Engineers.

2. The meeting was opened by General Foote who briefly reviewed progress to date on the Columbia River studies. He stated that as a result of the March 12, 1956, meeting of the Advisory Committee on Fish and Wildlife it was apparent that there were fish or wildlife problems of varying degrees of severity in connection with nearly every project. He indicated that he was deeply concerned with these problems and hoped that mutually satisfactory solutions could be worked out. He stated that system power studies are well underway and that the recently established Board of Consultants was satisfied that the Corps

of Engineers was proceeding on a sound and realistic basis. Project studies by the district offices and the Bureau of Reclamation are continuing and a list of projects which appear to be economically feasible and reasonably acceptable has been prepared. It is planned to study these projects in more detail.

3. Mr. Lewis discussed system power studies currently underway and outlined future power studies contemplated in connection with the review study. Preliminary evaluations of studies to date indicate that the 1975 load could be met with the sequence IV system at an annual cost considerably less than that for the sequence V system. Sequence IV contains more storage than sequence V and a correspondingly lesser amount of thermal. Studies will be continued to further compare sequences IV and V at the 1985 and subsequent load levels and studies will be initiated shortly to analyze the sequence III system which contains Canadian storage.

4. Mr. Rees reviewed the derivation of a tentative power benefit value which would be used in benefit-to-cost analyses in the current report. The proposed new power value is based on the cheapest alternative means of securing power to meet the load and is predicated on the assumption that by approximately 1985 all Federal power will be required to meet the loads of the public utility districts and municipally owned systems. Accordingly, after that date the cheapest alternative source to the users of Federal power would be non-Federal publicly financed steam. On the basis of present worth of current and projected future alternative costs the value of power at the market is computed to be $12.50 per kilowatt of capacity and 3.0 mills per kilowatt-hour of energy.

5. Mr. Brown reviewed project studies conducted to date by the district offices and the Bureau of Reclamation. He pointed out that informal meetings had been held with small groups of leading citizens and interests at Spokane, Wash.; Missoula and Kalispell, Mont.; LaGrande, Oreg.; and with the J. Neils Lumber Co. and Montana Power Co. for the purpose of discussing possible water resource development projects in specific areas. A similar meeting is scheduled to be held in Lewiston, Idaho, in the near future. Data on the various projects being studies by the district offices are attached hereto as enclosures 1 and 2.

6. General Foote remarked that he was somewhat concerned about the Libby project and that in reality there was no basis for including it as a project in reasonable prospect and under active consideration. He also indicated that there was considerable opposition to the Clearwater projects by wildlife and recreation interests. The State of Idaho and the Fish and Wildlife Service are studying these problems and are obtaining data which will permit a realistic appraisal of the matter.

7. Mr. Colby suggested that we retain the Swan River project on our list for the time being, at least through the public hearings to be held in May. He indicated that two rather strong committees in the Missoula area were supporting the Nine Mile Prairie project currently under investigation by the Bureau of Reclamation.

8. Mr. Kulp stated that local interests were pretty much sold on the Guffy project and probably would be adverse to the Marsing project if it would result in any delay or handicap in the securing of authorization and funds for Guffy or a suitable replacement. He also indicated that local interests had pretty much accepted the proposed Garden Valley project. Principal problems involved would be restoration of forest access and management facilities. He indicated that the people in Boise and vicinity would probably like to have a public hearing held in that area.

9. Mr. Fernald stated that the Canadian Government was pushing the investigation of various schemes for development of the water resources in the Canadian portion of the basin. An engineering firm is studying plans for diversion of Columbia River waters into the Fraser River and the Murphy Creek project. The Canadian Government is drilling several dam sites and studies are in progress.

10. Mr. Norwood suggested that the Corps of Engineers clearly state the flood-control objective of the review investigation and that in case it is impossible to obtain sufficient acceptable storage to accomplish this objective we leave enough flexibility in the plan so that the objective can be met at some future date. For example, nothing should be done at this time to block the future construction of Paradise on the Clark Fork River, Glacier View on the North Fork of the Flathead River, or Shankers Bend on the Similkameen River. He pointed out that 50 years from now the goal may be to control the 1894 flood to a flow of 600,000 cubic feet per second at The Dalles in lieu of the 800,000 cubic feet per second envisioned in House Document 531. Mr. Brown

stated that the report would have to answer these questions and meet a stated goal.

11. Mr. Brown stated that the public hearings would probably be held in May or June and inquired of the committee if it could see any reasons for not initiating field surveys and foundation exploration work prior to the public hearings. None of the committee members indicated there would be any known objections to such a procedure.

Preliminary Appraisals, Snake River Basin, by Corps of Engineers, United States Army

Preliminary appraisals of projects considered worthy of more detailed study are presented herewith together with sketches showing reservoirs and typical dam sections. There is also included a tabulation of projects which have been deferred for future consideration only if later found desirable.

The projects proposed for further study are:

Project	River	River mile	Usable storage	Installed capacity
			Acre-feet	*Kilowatts*
Marsing	Snake	426	830,000	120,000
Garden Valley	South Fork, Payette	4	1,000,000	90,000
Rays Ferry	Grande Ronde	19	970,000	135,000
Asotin	Snake	151	Pondage	360,000
Clarkston	do	141	Pondage	135,000
Total			2,800,000	840,000

MARSING

The Marsing Dam site is located at mile 426 on Snake River, 5 miles above the town of Marsing and about 70 river miles above Weiser, Idaho. The dam would be an earth and rock fill structure with a hydraulic head of 131 feet. The spillway would best be located in the left abutment and would probably be of the chute type to reduce foundation loading. The width of the valley at this site is about 7,000 feet and some 12 million yards of fill material would be required for a dam 137 feet high. The dam and apputenant structures would be located on lake bed materials but this condition is not expected to present any insurmountable problems. Diversion and power conduits would probably be cut-and-cover structures on the valley floor. The powerplant of 120,000-kilowatt capacity would be located well below the toe of the dam.

The average annual runoff is about 6,555,000 acre-feet. The lake behind the dam, with normal pool elevation of 2,354 feet mean sea level, would create a reservoir 56 miles long and provide space, in the upper one-third, for 830,000 acre-feet of joint-use storage. Normal pool elevation is the same as proposed by the Bureau of Reclamation for the Guffey site, and is limited in height in order to avoid adverse effects on Grandview and adjacent irrigated lands. The reservoir, with a total area of 26,000 acres, would flood out about 4,500 acres of irrigated land in the Reynolds, West Reynolds, and Opaline Irrigation Districts, and some narrow strip on the north side of the river totaling 1,600 acres. In addition, the 12,000-kilowatt Swan Falls powerplant of the Idaho Power Co., located about 30 miles upstream from the Marsing site, would be inundated.

The Bureau of Reclamation has recently issued a reconnaissance report proposing a run-of-river dam at the Guffey site, located about 18 miles above the Marsing site. This project would reduce pumping lifts to some 27,000 acres of irrigable land downstream and on both sides of Snake River but does not provide significant usable storage. The Marsing site, proposed herein, would serve as an alternate to the Guffey site, insofar as irrigation is concerned. In addition, the storage of 830,000 acre-feet would also provide downstream and local flood-control benefits. The project would supply about 33 percent more at-site power than would the Guffey site; also by regulation and release of stored waters would increase firm power production at all downstream sites.

Pertinent data and cost, based on very preliminary and approximate estimates, are shown in the following tabulation. The full installed power capacity and energy output are assumed to be usable under the load.

Height of dam (hydraulic)—feet	131
Normal pool elevation—feet mean sea level	2,354
Normal tailwater elevation—do	2,223
Installed power capacity—kilowatts	120,000
Usable joint-use storage—acre-feet	830,000
Spillway capacity—cubic feet per second	250,000
Average annual runoff—acre-feet	6,555,000
Annual firm energy at site—kilowatt-hours	716,600,000
Average annual increase in energy at downstream power sites	(1)

CAPITAL COST

Power facilities	$16,400,000
Joint-use facilities	28,610,000
Flood-control facilities	3,680,000
Capital cost	48,690,000
Total annual charges	2,480,000

ANNUAL BENEFITS

Flood control	700,000
Irrigation	(2)
Power at site (based on preliminary Federal costs for thermal power for the upper Snake reach):	
Capacity	1,570,000
Energy	3,124,000
Power added downstream	(2)
Subtotal	4,694,000
Total annual benefits	5,394,000
Benefit-cost ratio	2.17
Power (based on Pacific Northwest regional power values):	
Capacity	1,015,000
Energy	2,229,000
Subtotal	3,244,000
Total annual benefits	3,944,000
Benefit-cost ratio	1.59

[1] Not estimated.
[2] Not evaluated.

GARDEN VALLEY

The Garden Valley site, Payette River, Idaho, has previously been recommended by the Bureau of Reclamation in connection with the Mountain Home irrigation project, and is fully described in that connection in House Document 531. Other solutions are now under study for the Mountain Home irrigation development, and consideration of the Garden Valley project is herein directed toward its possible adoption into a regional plan in the primary interests of flood control and power.

The dam site is located in a narrow canyon on Payette River about 3 miles above the confluence of the North Fork and about 4 miles below the mouth of the Middle Fork. The deep and extremely narrow canyon is cut through granitic formations with little overburden. The average annual runoff is 1,170,000 acre-feet, in addition to which it is anticipated that 600,000 acre-feet will be diverted from the North Fork through the Scriver Creek development, providing a total water supply of 1,770,000 acre-feet.

The dam would be a concrete arch with a hydraulic head of 354 feet with a usable storage of about 1 million acre-feet. The spillway would be a glory hole

type designed to pass 100,000 second-feet. The flood-control outlets would be through the dam if possible; if that method cannot be used, an intake tower and tunnel would be needed for reservoir drawdown. Power facilities would consist of a 90,000-kilowatt installation with the powerhouse probably located at the toe of the dam, served by penstocks through the dam. An alternative plan for underground location of the power station is also to be considered.

The lake behind the dam, with normal pool elevation of 3,266 feet mean sea level, would create a reservoir extending up the Middle Fork about 13 miles and up the main stem and South Fork about 16 miles, inundating some 11,200 acres. The area flooded on the South Fork would be the intermountain basin known as Garden Valley where the land in the valley floor is used for production of hay, grain, and pasture. Two small communities with a total population of about 60, and 15 or 20 farmsteads would be inundated. A large part of the reservoir area is covered with brush and timber and is used for grazing.

Of the total 1 million acre-feet usable reservoir capacity, about 850,000 acre-feet would be effective for flood control. Addition of this new storage to that already existing at Cascade and Deadwood Reservoirs would result in almost complete control of floods in Payette Valley and also aid in reducing flood peaks on lower Snake and Columbia Rivers. Downstream flood-control benefits have been derived as a part of the main control plan for lower Columbia River. The entire storage capacity would be effective in regulating Payette streamflows in the interests of downstream power development over more than 2,000 feet of gross head, including Brownlee, Oxbow, Hells Canyon, Pleasant Valley, Mountain Sheep, China Gardens, Asotin, Clarkston, four lower Snake projects, McNary, John Day, The Dalles, and Bonneville.

Pertinent physical and cost data, based on very preliminary estimates, are shown below:

Height of dam (hydraulic): 354 feet.
Normal pool elevation: 3,266 feet mean sea level.
Spillway capacity: 100,000 cubic feet per second.
Usable joint-use storage: 1 million acre-feet.
Installed power capacity: 90,000 kilowatts.
Average annual energy at site: 440,300,000 kilowatt-hours.
Average annual energy downstream: Not estimated.
Average annual water supply: 1,770,000 acre-feet.
Capital cost: $35,524,000.
Annual cost including taxes foregone: $1,813,000.

Annual benefits based on preliminary Federal costs for thermal power for upper Snake area:	
Flood control	$340,000
Power at-site capacity	1,177,000
Energy	1,920,000
Power added downstream	(1)
Subtotal	3,097,000
Total	3,437,000
Benefit-cost ratio	1.90
Annual benefits based on Pacific Northwest: Regional power values:	
Flood control	340,000
Power at-site capacity	761,000
Energy	1,369,000
Power added downstream	(1)
Subtotal	2,130,000
Total	2,470,000
Benefit-cost ratio	1.36

[1] Not evaluated.

Above power benefits and economic benefit-to-cost ratios do not reflect the very substantial downstream power benefits that could be achieved through regulation of storage at Garden Valley since that study has not yet been undertaken. In the orderly development of Payette River the Scriver Creek diversion is assumed

to preceded construction of the Garden Valley project. This project is a head development and diverts water from the North Fork at Smith Ferry to the Middle Fork above Garden Valley. North Fork flows are regulated at Cascade Reservoir to such an extent that approximately all of the flow can be diverted to the Scriver Creek project. This development is assumed to be economically feasible. No benefits are assigned to Garden Valley project from Scriver Creek.

RAYS FERRY

The Rays Ferry Dam site is located in the State of Washington on Grande Ronde River 18.6 miles above its mouth, near the crossing of State Highway No. 3, and about 12 miles southwest of Anatone, Wash. Primary purposes of the project would be development of storage for regulation of Grande Ronde River flows in the interests of downstream flood control and power.

The average annual runoff at the site for the period 1928 through 1948 was 1,946,000 acre-feet. The site selection is a tentative one, based on preliminary comparative office studies of alternate locations which included the Narrows site, mile 2; Troy, mile 41; Elbow Creek, mile 64; and Rondowa, mile 79. No field reconnaissance has been possible; therefore, cost estimates developed will be subject to considerable refinement. While the Ray Ferry site appears to have the best financial feasibility, further investigations of the other sites should be undertaken before final decisions are made.

The dam would have a hydraulic height of 556 feet, creating a reservoir with a usable storage capacity of 970,000 acre-feet. Indications are that an embankment-type dam would be least expensive. A gated chute-type spillway located on one abutment would pass a spillway design flood estimated at 75,000 second-feet. Reservoir drawdown would be accomplished by outlet works located in one abutment supplemented by flow through the powerplant. Power facilities would consist of 135,000 kilowatts installed capacity served by intake tower, tunnel, and penstocks.

The lake formed by the dam, at normal pool elevation of 1,672 feet mean sea level, would back water upstream for about 25 miles and inundate about 7,000 acres in Oregon and Washington. The reservoir area is sparsely vegetated and lies almost entirely within the canyon walls. The main flowage problem in the reservoir area would be relocation of the small town of Troy, Oreg., consisting of a general store, a tavern, a motel, and a half-dozen residences. Some forest service roads would need to be relocated.

Pertinent data pertaining to the proposed project are approximately as shown in the following tabulation:

Height of dam (hydraulic)	feet	556
Normal pool elevation (mean sea level)	do	1,672
Tailwater elevation (mean sea level)	do	1,116
Installed power capacity	kilowatts	135,000
Usable joint-use storage	acre-feet	970,000
Spillway capacity	cubic feet per second	75,000
Average annual runoff	acre-feet	1,946,000

	Kilowatt hours
Average annual energy at site	632,900,000
Downstream (lower Columbia and lower Snake)	606,700,000
Downstream (Clarkston and Asotin)	126,500,000
Total energy	1,366,100,000

Preliminary estimates of capital cost, annual charges, and benefits are shown in the following tabulations. The principal flood-control benefits would be derived as a part of the main control plan for the lower Columbia River. Benefits from at-site power are evaluated with respect to both capacity and energy. In addition, the energy generation at existing and potential downstream projects resulting from storage releases is evaluated by groups as shown:

Costs:	
Power facilities	$15,700,000
Dam and other joint facilities	50,642,000
Flood-control facilities	5,700,000
Total capital cost	72,042,000
Annual charges, including taxes foregone	3,420,000

Benefits:	
Flood-control benefits	$510,000
At-site power benefits	3,109,000
Downstream power benefits (lower Snake and lower Columbia Rivers)	1,884,000
Total benefits	5,503,000
Benefit-cost ratio (1.61)	
Additional downstream power benefits, middle Snake group	393,000
Grand total	5,896,000
Benefit-cost ratio	1.72

ASOTIN

Asotin Dam site is located in the States of Washington and Idaho on Snake River 11 miles above Lewiston and 151 miles above the mouth. The plan as now being studied is somewhat different from that described in House Document 531. The average annual runoff at the site for the period from 1910 through 1946 is estimated to have been 22,480,000 acre-feet. It is estimated that after upstream irrigation depletion, the mean annual runoff would be about 19 million acre-feet. The pillway design flood is 640,000 second-feet which is nearly 2½ times as great as the peak discharge of the 1894 flood.

The dam would be a straight gravity-type concrete structure with a crest length of 1,400 feet and an effective hydraulic height of about 100 feet. The navigation lock would be adjacent to the left abutment and a radial-gated overflow spillway about 350 feet long would be located riverward of the navigation lock with a capacity to pass the design flood of 640,000 second-feet. A powerhouse 580 feet long would be located at the toe of the dam between the spillway and the right abutment. The power installation would probably consist of four 90,000-kilowatt generators, representing a total installed capacity of 360,000 kilowatts, with an average annual generation of 1,691,000,000 kilowatt-hours.

Space would be made available for a fifth generator, which may be desirable, but its feasibility has not been fully determined. Two fishways would be provided, one located through each abutment.

The pool formed by the dam would have a normal operating level of 860 feet above sea level, operated for pondage, and would extend upstream about 24 miles to the China Gardens Dam site. Lands affected by the reservoir would be in Oregon, Washington, and Idaho. Except for small areas of tillable land on narrow river benches at the foot of steep mountain slopes, the land in the reservoir is unsuitable for cultivation. Improvements in the reservoir area comprise about 10 ranch units, 20 miles of county road, and some local telephone and electric power lines.

The Asotin project, in conjunction with the downstream Clarkston and lower Snake projects, would extend the slackwater navigation system of the lower Snake River upstream to above the mouth of Grande Ronde River and Lime Point, Oreg., the location of a major deposit of high-grade limestone. The improved navigation conditions, by permitting use of deeper draft equipment and reduced power requirements as compared to an open river channel, would foster development of the natural resources of the area. Navigation aspects of the Asotin and Clarkston projects are further discussed in connection with the latter. Power production of the project would be integrated into the Northwest power pool. The extension of the reservoir into the scenic and rugged Snake River Canyon provides an important recreational attraction to this area.

The following tabulation shows preliminary estimated project costs and benefits. Capital costs include temporary construction, engineering, supervision, and contingencies. Annual costs include taxes foregone. Power benefits indicated would result under ultimate system and project operating conditions, assuming all energy and capacity usable under the load. Navigation benefits

are assumed to be equal to the cost of specific navigation facilities. The capital cost of a five-unit power project would be about $11 million higher.

Capital cost (360,000 kilowatts): [1]	
Power facilities	$54,707,000
Navigation facilities	20,399,000
Other direct facilities	60,000
Joint facilities	39,697,000
Total project capital cost	114,863,000
Annual charges:	
Power facilities	3,438,000
Navigation facilities	867,000
Other direct facilities	12,000
Joint facilities	1,695,000
Total annual charges	6,012,000
Annual benefits:	
Power:	
Capacity	3,047,000
Energy	5,252,000
Subtotal	8,299,000
Navigation	867,000
Total annual benefits	9,166,000
Benefit-to-cost ratio	1.52

[1] Cost of a 4-unit project complete.

CLARKSTON

Clarkston Dam site is located in Washington and Idaho on Snake River 141 miles above its mouth, at the southern boundary of the cities of Lewiston, Idaho, and Clarkston, Wash., 1 mile above the mouth of Clearwater River. The runoff at the Clarkston site is essentially the same as at the Asotin site.

The dam would be a straight, gravity-type concrete structure, with a crest length of 1,300 feet and an effective hydraulic height of about 45 feet. The navigation lock would be adjacent to the left abutment and a vertical-gated overflow spillway about 610 feet long would be located riverward of the navigation lock with a capacity to pass the design flood of 640,000 second-feet. A powerhouse 500 feet long would be located at the toe of the dam between the spillway and the right abutment. Preliminary studies indicate that the power installation would consist of three 45,000-kilowatt units, representing a total installed capacity of 135,000 kilowatts with an average annual generation of 775 million kilowatt-hours. Space would be made available for a fourth generator, but its feasibility has not been determined. Two fishways would be provided, one located through each abutment. Limited studies indicate the site to be satisfactory for a low dam. Seepage from the reservoir may occur through an old filled canyon around the left abutment but such a problem is not considered to be serious.

Normal operating pool level for the project would be at elevation 760 feet above mean sea level, and the reservoir would extend upstream 10 miles to the Asotin Dam site. Lands within the reservoir lie in the States of Idaho and Washington. Improved lands located on narrow benches which border the river at the toe of steep slopes will be inundated. There are 26 farmsteads, most of which are located on the left bank adjacent to the river and Washington State Highway No. 3. Business and residential sections of the town of Asotin, which would otherwise be inundated by the reservoir, would be protected by a system of levees.

Improvement of the navigation channel in Snake River above Lewiston has previously been considered by means of open river channel work to the vicinity of Grande Ronde River. The Clarkston and Asotin projects, in lieu thereof, would provide slackwater navigation improvement in extension of the authorized lower Snake River projects. Such slackwater improvement would be consistent with the congressional authorization for the lower Snake projects which specified provision of slackwater pools, making navigation independent of the effects of fu-

ture upstream irrigation depletions. The Clarkston project would produce much improved navigation conditions and develop a substantial block of power for integration into the Northwest power pool. The proximity of dam and reservoir to the towns of Lewiston, Clarkston, and Asotin would make the project of special interest for recreational purposes.

Supplemental use of water from the pool to irrigate 2,500 acres near Clarkston, now inadequately supplied, would be of particular value to the community. The dam would stabilize the water table, decrease the pumping lift, and make available low-cost power for pumping purposes. Under these conditions some new land could be brought under irrigation.

Determination of detailed benefits attributable to development of slackwater navigation by construction of Clarkston and Asotin Dams is dependent upon final establishment and approval of waterway traffic and resultant savings as presented in the Columbia River Navigation Report of May 31, 1955. It is the opinion of this district that annual navigation benefits to be derived from slackwater development incidental to construction of Clarkston and Asotin Dams will be in excess of the annual cost of providing an adequate lock, approach channels, and other necessary navigation facilities.

The following tabulation shows preliminary estimated project costs and benefits. Capital costs include temporary construction, engineering, supervision, and contingencies. Annual costs include taxes foregone. Power benefits indicated would result under ultimate system and project operating conditions assuming all energy and capacity usable under the load. Navigation benefits are assumed equivalent to the costs of specific navigation facilities.

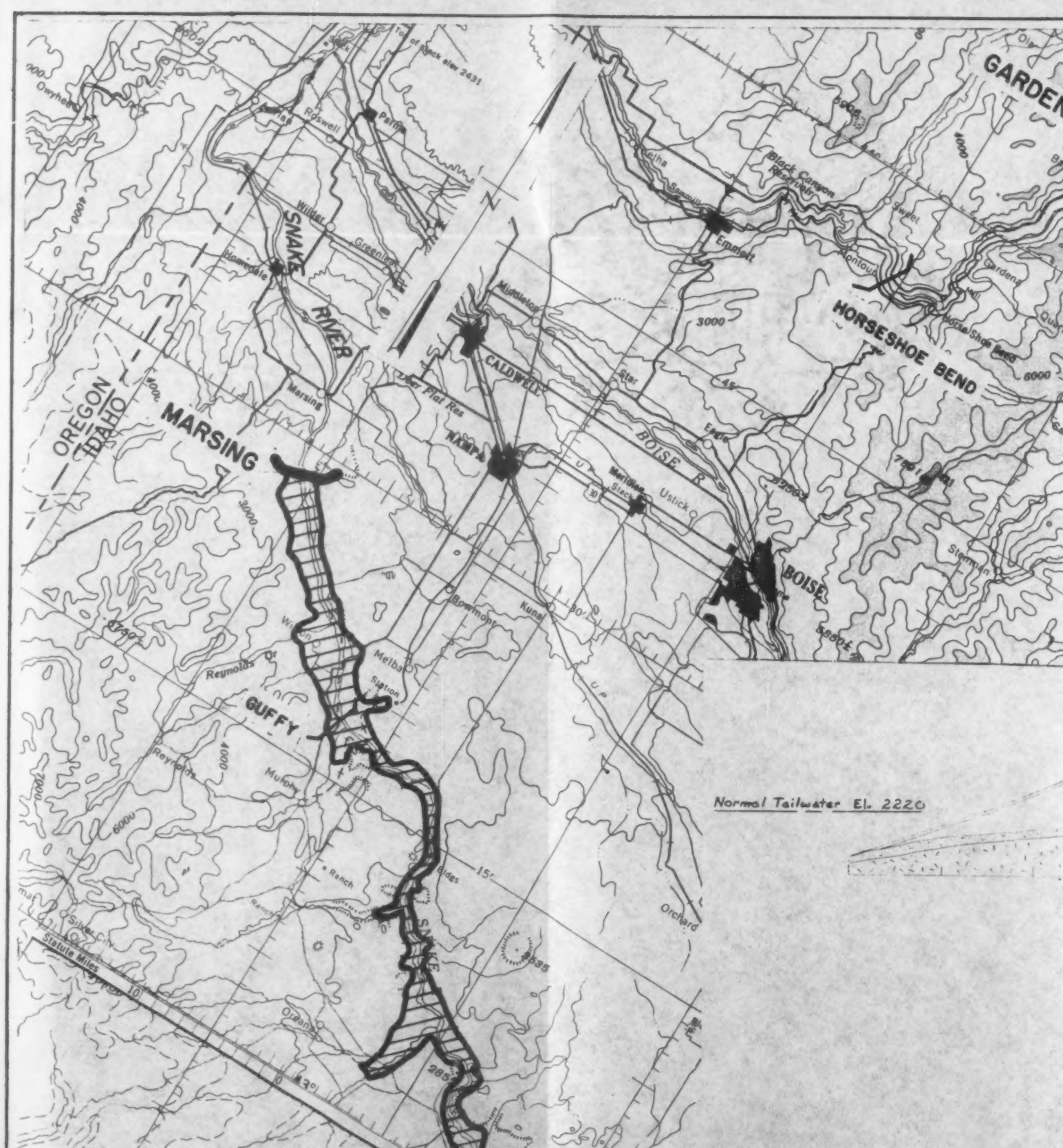
Capital cost (135,000 kilowatts): [1]	
Power facilities	$36,225,000
Navigation facilities	12,210,000
Other direct facilities	56,000
Joint facilities	21,282,000
Total project capital cost	69,773,000
Annual charges:	
Power facilities	1,940,000
Navigation facilities	519,000
Other direct facilities	14,000
Joint facilities	987,000
Total annual charges	3,460,000
Annual benfits:	
Power:	
Capacity	1,142,000
Energy	2,407,000
Subtotal	3,549,000
Navigation	519,000
Total annual benefits	4,068,000
Base cost ratio	1.18

[1] Cost of a 3-unit project complete.

Columbia River comprehensive review report, Snake River Basin—Projects deferred on the basis of office studies

Site	Stream	Stream-mile	Average annual runoff (acre-feet)	Dam		Usable storage (acre-feet)	Reservoir length (miles)	Installed capacity (kilowatts)	Capital cost
				Type	Hydro head (feet)				
Thousand Springs [1]	Snake River	592	2,500,000	Embankment	190	500,000	24	120,000	$50,000,000
Horseshoe Bend [2]	Payette River	47	2,220,000	do	450	850,000	25	100,000	64,000,000
Narrows [3]	Grande Ronde River	2	2,000,000	do	503	1,000,000	26	125,000	75,500,000
Troy [3]	do	41	1,946,000	do	545	970,000	23	130,000	84,000,000
Elbow Creek [3]	do	64		do	[4] 400	200,000	14		
Rondowa [3]	do	79	1,389,000	do	397	[5] 515,000	22	55,000	48,500,000
China Gardens [6]	Snake River	176	21,500,000	Concrete	90	[7]	23	320,000	88,400,000

[1] Deferred in favor of the Marsing site where flood control storage would be more effective and where a larger storage space is available with fewer flowage problems.
[2] Deferred in favor of the Garden Valley site where the cost for similar facilities would be much less. Flowage problems are a major item at this site.
[3] Deferred, as a result of a site selection study, in favor of the Rays Ferry site.
[4] Investigations at the Elbow Creek site were stopped when it was revealed that a 400 foot dam would provide storage space for less than 200,000 acre feet.
[5] 690,000 acre feet needed for optimum use of the runoff.
[6] Deferred primarily because of inadequate navigation benefits. This project would be available for development by private enterprise.
[7] Pondage.



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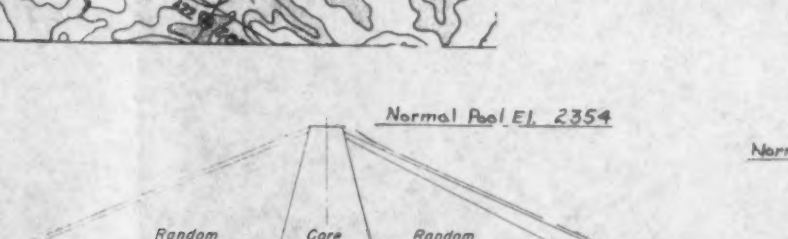
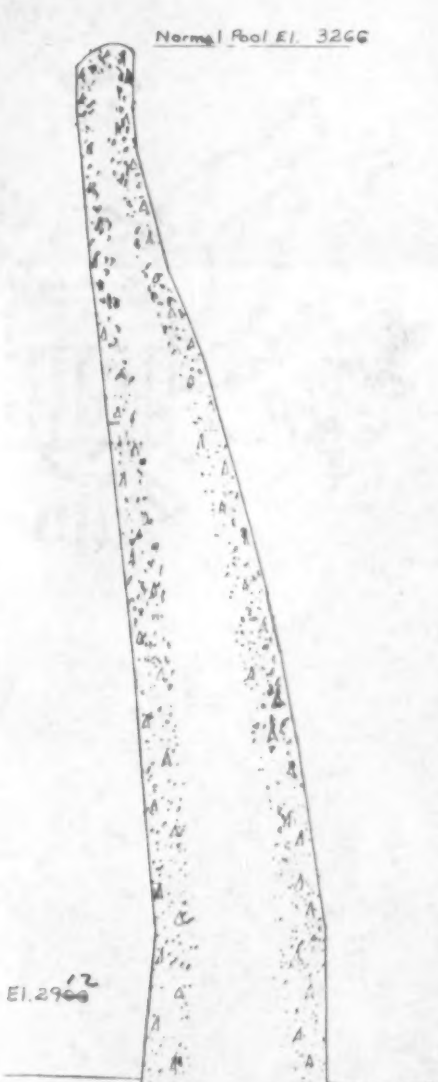


MARSING DAM

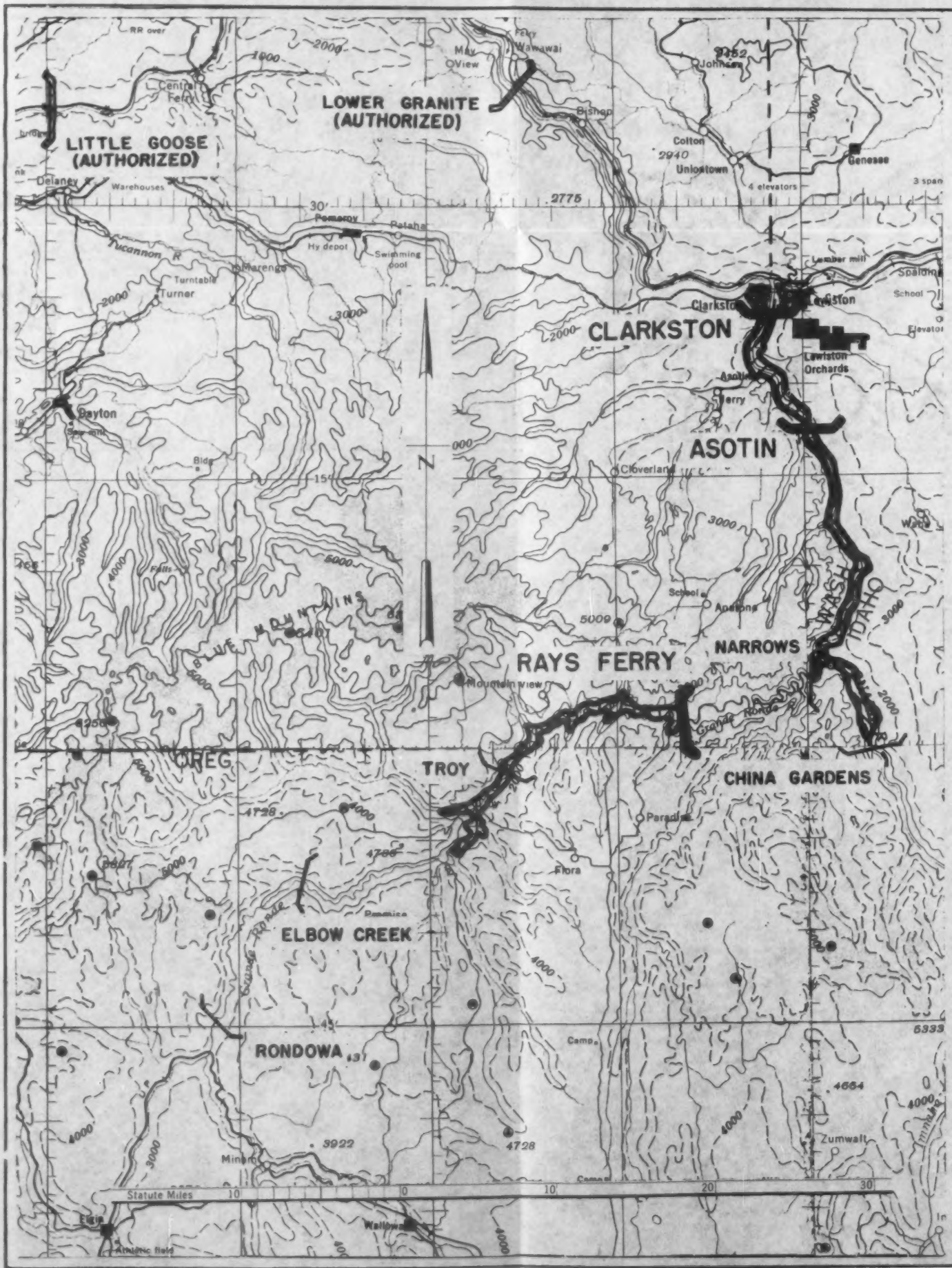


GARDEN VALLEY DAM

TYPICAL SECTIONS
NOT TO SCALE

PROPOSED FOR STUDY
MARSING
GARDEN VALLEY

WALLA WALLA DISTRICT, CORPS OF ENGINEERS
DATE: 20 FEBRUARY 1956



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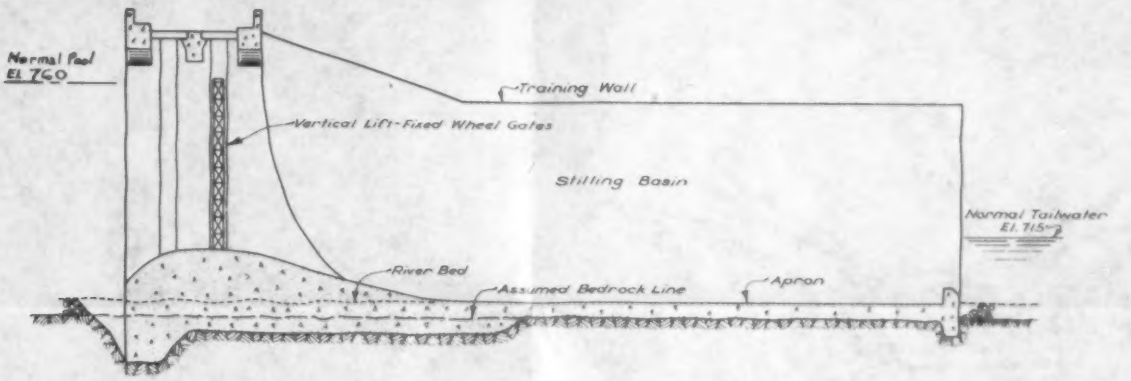
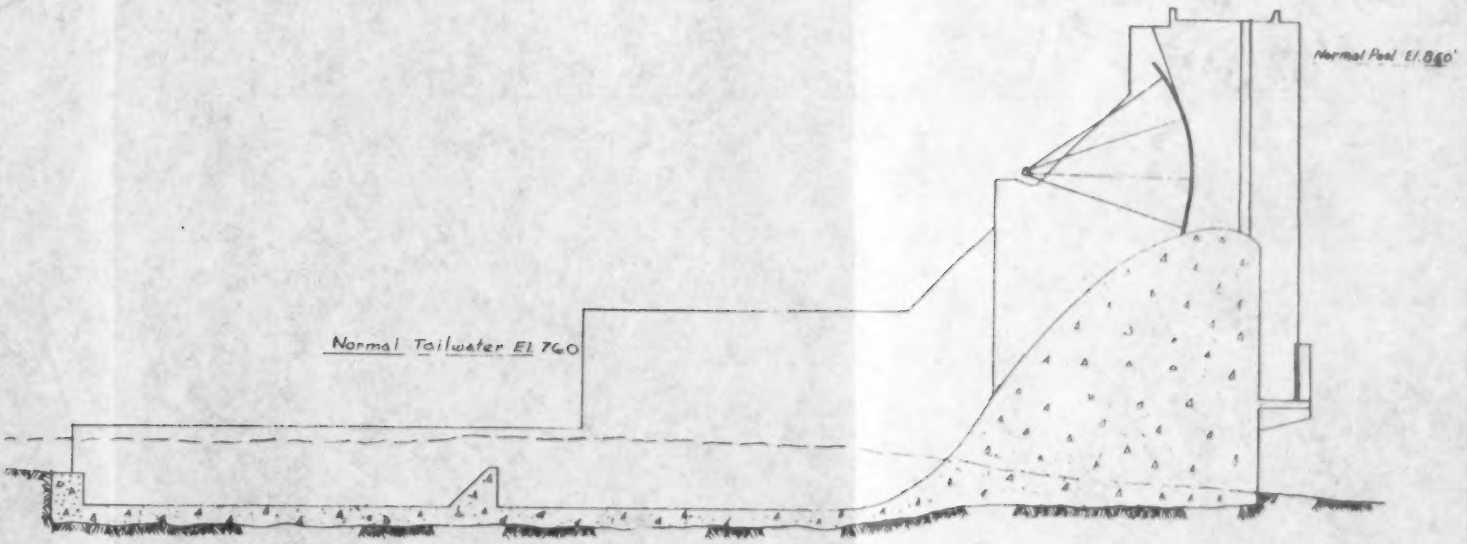
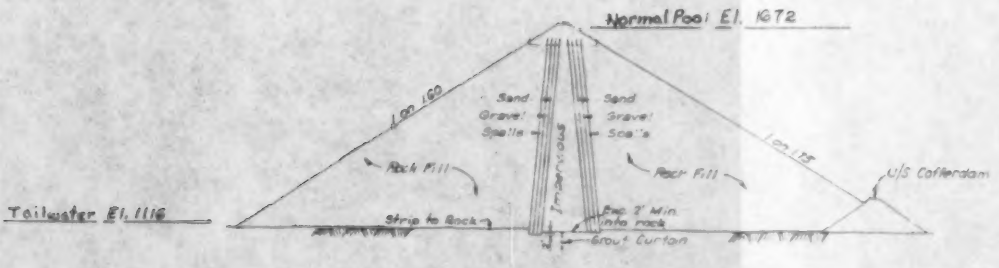


CLARKSTON DAM



ASOTIN DAM



RAYS FERRY DAM

TYPICAL SECTIONS
NOT TO SCALE

PROPOSED FOR STUDY
ASOTIN
CLARKSTON
RAYS FERRY

WALLA WALLA DISTRICT, CORPS OF ENGINEERS
DATE: 20 FEBRUARY 1956

Preliminary appraisals of storage projects

PROJECTS UNDER STUDY

Site	Usable storage	Gross head
Clark Fork Basin:	*Acre-feet*	*Feet*
Thompson River	100,000	250
Ninemile Prairie, Blackfoot River	960,000	307
Buffalo Rapids No. 4, Flathead River	568,000	168
Flathead Lake Outlet Improvement	500,000	(1)
Smoky Range, Flathead River	1,500,000	350
Spruce Park, Middle Fork, Flathead River	300,000	750
Subtotal	3,928,000	1,825
Spokane River Basin: Enaville, Coeur d'Alene River	805,000	267
Kootenai River Basin:		
Libby, Kootenai River	5,010,000	344
Long Meadows, Yaak River	450,000	190
Subtotal	5,460,000	534
Wenatchee River Basin: Wenatchee and Chiwawa Rivers	150,000	475
Okanogan River Basin: Nighthawk, Similkameen River	30,000	(1)
Columbia River, Main Stem: Grand Coulee Dam	3,000,000	
Grand total	13,373,000	3,101

PROJECTS ELIMINATED

Clark Fork Basin:		
Lolo Creek	103,500	395
Atkins, Rock Creek	140,000	(1)
Ovando, Blackfoot River	310,000	197
Little Bitterroot River	60,000	125
Swan River	320,000	187
Stillwater River	120,000	210
Subtotal	1,053,500	1,114
Spokane River Basin: St. Joe River	200,000	(1)
Kettle River Basin: Curlew, Kettle River	150,000	(1)
Kootenai River Basin: Meadow Creek, Moyie River	320,000	250
Grand total	1,723,500	1,364

[1] Storage only.

NARRATIVE REPORT—THOMPSON RIVER PROJECT, THOMPSON RIVER, MONT.

1. *Project description.*—A storage project on the Thompson River, at a site about 8 miles upstream from the mouth of the river, is under study by the United States Bureau of Reclamation. From miscellaneous streamflow measurements, precipitation, and the average increase in streamflow of the Clark Fork, between Plains and Heron, Mont., it is estimated that the annual runoff of the Thompson River is about 335,000 acre-feet. A dam 380 feet high with a pool at elevation 3,020 would be required for this amount of storage.

2. The project presently being considered would have a dam about 300 feet high with a crest length of 1,100 feet. A pool elevation at 2,950 would provide 160,000 acre-feet of gross storage with 100,000 acre-feet usable with a drawdown of about 80 feet.

3. The reservoir would inundate an undeveloped forest-covered area. Any storage site on the Thompson River would require the relocation of a Forest Service road for the entire length of the reservoir.

4. *Estimated costs and benefits.*—On the basis of limited available data, prime power at site for a project having a pool elevation of 2,950 would be approximately 6,400 kilowatts. Downstream power would be about 25,000 kilowatts. A rough estimate of the cost of the dam at the site would be $35 million. A comparison of the annual power benefits with the project annual costs indicates that the benefit-to-cost ratio would be less than unity.

5. *Project accomplishments.*—The Thompson River project would provide at-site and downstream power with a reservoir located in an undeveloped area.

6. *Known problems and objections.*—The project would inundate a stream fishing area and would require studies to evaluate and resolve these problems.

NARRATIVE REPORT—NINEMILE PROJECT, BLACKFOOT RIVER, MONT.

1. *Project description.*—The Ninemile project described herein was presented in House Document No. 531. The project is currently under study by the United States Bureau of Reclamation and may be modified as a result of its findings. Ninemile Dam site is on the Blackfoot River at river mile 22, approximately 39 highway miles east of Missoula, Mont. The dam would be an earth-fill structure about 400 feet high, having a top elevation of 3,855 and a crest length of 3,500 feet. Full pool would be at elevation 3,840 providing gross storage of 1,230,000 and usable storage of 960,000 acre-feet, with 35 percent drawdown. The gross head between a headwater elevation of 3,840 and a minimum tailwater elevation at 3,533 is 307 feet. The spillway would consist of an 18-foot, concrete-lined chute on the left bank and a concrete weir with crest at elevation 3,822. It would be equipped with tainter gates capable of discharging 51,000 cubic feet per second.

2. Current studies are being directed toward a reduction of the pool level to permit annual refill and the maintenance of a full reservoir during the summer months. This may result in the selection of a maximum water surface as low as elevation 3,800. With this lower pool, the gross storage would be 750,000 acre-feet and would provide about 600,000 acre-feet of usable storage for flood control and power.

3. The powerhouse would be located on the right bank about 100 feet downstream from the toe of the dam. Two vertical shaft Francis turbines would drive 37,000-kilowatt generators. An 18-foot concrete-lined power tunnel would serve 12-foot steel penstocks to each turbine. A surge tank would limit pressure rise in the penstocks to 25 percent during normal head.

4. Access to the dam site would be by an existing county road and a branch line of the Chicago, Milwaukee, St. Paul & Pacific Railroad.

5. River diversion during construction would be through 18-foot-diameter tunnel which would later serve the powerhouse,. The tunnel would have a 10,000 cubic foot per second capacity under the head provided by the cofferdam.

6. The reservoir would inundate 13,400 acres of broad valley, which is principally privately owned rangelands interspersed with a few farms producing hay in connection with stock raising. This project would require relocating 19 miles of the Chicago, Milwaukee, St. Paul & Pacific Railroad log haul rail spur line, 14 miles of State highway and about 14 miles of telephone lines.

7. *Estimated costs and benefits.*—The costs and benefits are based on available information and are tentative subject to modification by findings of further studies by the Bureau. Based on January 1956 price levels, the total construction cost of Ninemile project with a 5-year construction period is $60 million. Annual costs for this project is $2,820,000. Power at site would have an annual value of $990,000. Downstream power benefits would have an annual value of $2,280,000 for plants now existing, under construction, or proposed. Downstream flood-control benefits are estimated to be $360,000. Local flood-control benefits in the vicinity of Missoula and downstream along Clark Fork have not been evaluated or included in estimate of benefits. A comparison of project benefits of $3,270,000 with project annual costs gives a benefit-to-cost ratio of 1.3.

8. *Project accomplishment.*—Ninemile project, with 960,000 acre-feet of usable storage, has sufficient capacity to accomplish almost complete regulation of the stream while not exceeding the physical limitations of the site. Use of the reservoir for both flood control and power would cause no conflict. In average years, flood reservation requirements would be available as a result of normal power operation through the winter. Even in years when extreme flood flows are anticipated, it is believed all floods at the site could be controlled without sacrifice of potential prime power. Crests of damaging floods on the main stem of the Clark Fork in the vicinity of Missoula, Mont., would be reduced between 30 and 50 percent. The total installed generator capacity of 74,000 kilowatts would produce 28,500 kilowatts of nominal prime power. The project storage would firm up flows at downstream sites of potential and existing run-of-river plants on the Clark Fork and on the Columbia River.

9. *Possible problems and objections.*—There are no known problems of major significance affecting the Ninemile project. Approximately 25 miles of Milwaukee branch line which is in good condition would require relocation; the portion above the dam would not be difficult, but relocation below the dam is in rugged terrain involving considerable rock excavation. Further studies of the effect of the project on fish and wildlife will be necessary to solve any problems

of this nature. The project now being studied would have a full reservoir during the summer months. This stable lake would enhance the recreational use of the area. Studies would also be required to satisfactorily resolve the problem of transportation facilities to service the forest areas adjacent to the reservoir.

NARRATIVE REPORT—BUFFALO RAPIDS NO. 4 PROJECT, FLATHEAD RIVER, MONT.

1. *Project description.*—Buffalo Rapids No. 4 project is on the Flathead River at river mile 37, about 36 miles downstream from Kerr Dam. The dam would be an earth-fill structure with an overall top length of approximately 10,000 feet. The powerplant and spillway structure would be in line with the axis of the dam and included in the overall length. The maximum height of the earth embankment for a length of 1,000 feet near the left bank of the river would be about 130 feet. For the remaining 8,000 feet, the height would be about 70 feet. The top elevation would be 2,710 feet. The full-pool elevation would be at 2,700; tailwater elevation at Kerr powerplant. This would provide a gross storage of 868,000 acre-feet. With a drawndown of 50 feet, the usable storage would be 568,000 acre-feet. The impervious core of the earth-fill embankment would be founded on brown clay which is sufficiently deep to control objectionable seepage. An overflow spillway controlled by 3 vertical lift gates capable of passing a flood of 175,000 cubic feet per second (about 1½ times the maximum flow of record) would be founded on rock in the right abutment.

2. The powerhouse would be located on the axis between the spillway and the earth embankment near the right bank. Individual penstocks through a gravity nonoverflow section would serve three Francis water wheels having a total installed generator capacity of about 150,000 kilowatts. Provision would be made in the initial construction for three future units. The gross head between a headwater elevation 2,700 feet and a minimum tail-water elevation 2,532 feet, would be 168 feet.

3. Access to the dam and powerhouse presents no problem and would be provided by extending existing roads. River diversion during construction would be accomplished by passing a maximum flow of 70,000 cubic feet per second through a channel in the right abutment.

4. *Reservoir area.*—The reservoir would inundate 16,600 acres of a sparsely settled valley. The land close to the riverbank is of poor quality and farm developments limited to scattered livestock ranches. Except for minor relocations, power and telephone lines, there would be no significant relocation problems.

5. *Estimated costs and benefits.*—The estimate of costs and benefits is preliminary and will be revised to conform to the results of more detailed studies based on more complete field data. Using January 1956 price levels with a 4-year construction period, the total construction cost is estimated to be $53,500,000. Annual costs for the project would amount to $2,650,000. Power at site would have an annual value of $2,500,000. Downstream power benefits for the 568,000 acre-feet of refill capacity in a median year would be $2,760,000 for plants now existing, under construction or proposed. Flood-control benefits are estimated to be about $400,000 annually. A comparison of total benefits of $5,660,000 with the project annual cost of $2,650,000 gives a benefit-to-cost ratio of 2.1.

6. *Project accomplishments.*—The Buffalo Rapids No. 4 project with 568,000 acre-feet of storage would provide 100,000 kilowatts of prime power at site and 140,000 kilowatts of downstream power. In addition this storage would have significant downstream flood-control benefits and may have irrigation possibilities. The lake created behind the dam would also add to the recreational use of the area.

7. *Possible problems or objections.* (a) The reservoir would flood about 8,000 acres of Indian land. The land is submarginal in character, having limited value for agricultural purposes.

(*b*) The project would flood dam sites at Buffalo Rapids No. 1 and No. 2 which have been considered by the Montana Power Co. and are now under preliminary Federal Power Commission permits.

(*c*) The Federal Power Commission has issued a preliminary permit to the Montana Power Co. on the Buffalo Rapids No. 4 site. This site has been considered by that company for both head and storage developments.

(*d*) Studies of the effect of the project on fish and wildlife will be required to determine the extent and solution of any problems.

NARRATIVE REPORT—FLATHEAD LAKE OUTLET CHANNEL IMPROVEMENTS, FLATHEAD RIVER, MONT.

1. *Project description.*—This project is essentially the removal of a natural outlet restriction. A channel beginning at a point near Flathead Lake and extending about 10,000 feet downstream would be excavated to a bottom width of about 200 feet. Approximately 1,250,000 cubic yards of common material would be removed from the natural streambed. The channel would be alined so that a minimum of excavation would be made in rock. The channel improvement would increase the capacity of the outlet, at a lake elevation of 2,883, from 5,000 cubic feet per second under present conditions to 30,000 cubic feet per second. This would result in an increase in the total usable storage for flood control from 680,000 acre-feet to about 1,180,000 acre-feet between elevation 2,883 and 2,893, the limits specified in the Federal Power Commission license for Kerr Dam. There are no plans to change these controlling lake elevations.

2. *Estimated costs and benefits.*—Costs and benefits are estimated from limited information on the type of material which would be encountered in the channel excavation and are subject to revision when additional data are obtained from subsurface explorations. Preliminary studies indicate that the channel can be improved for a construction cost of less than $5 million. With a construction cost of about $5 million the annual cost would amount to approximately $180,000. The additional 500,000 acre-feet of usable storage made available by the improvement would have a flood-control benefit on the lower Columbia River of not less than $350,000 assuming that this storage would be 70 percent effective. A comparison of benefits with costs gives a benefit-to-cost ratio of 2.0. The improved lake outlet would also benefit downstream plants by improving system operation and could improve the peaking capacity of the existing Kerr Dam. These power benefits have not been evaluated or included in the preliminatry economic study.

3. *Project accomplishment.*—This improvement would make the lake more effective for downstream flood control by permitting the discharge of high flows at the beginning of the spring flood period and thereby making 500,000 acre-feet of additional storage available for flood control. In low runoff years, the increased channel capacity would make it possible to fill the lake earlier in the season, because of the assurance that it would be possible to fill the lake without hazard of exceeding elevation 2,893. With this control of the lake, critical flooding along the lakefront would be eliminated because the lake level could be held at or below 2,893 for the maximum flood of record (1894 flood).

4. With the improved channel, it is possible that Kerr Dam, owned by the Montana Power Co., could develop greater peaking capacity during the low-water period. A more flexible and efficient operation of upstream storage at Hungry Horse and other potential projects will be possible because water released for downstream power will not be trapped in Flathead Lake, but can be released in conformance with system requirements.

5. *Possible problems or objections.*—The attached stage hydrographs show the lake levels during the high-water periods under present conditions and with the proposed channel improvements for a maximum flood year, a normal year, and a minimum dry year. In view of the elimination of lakeshore flooding, it is believed that the minor variations in the lake pattern indicated by the hydrographs should be generally acceptable to local interests.

NARRATIVE REPORT—SPRUCE PARK PROJECT, MIDDLE FORK OF FLATHEAD RIVER, MONT.

1. *Project description.*—The proposed Spruce Park project is on the Middle Fork of the Flathead River upstream from Bear Creek. The site is at river mile 50 about 5 miles upstream from United States Highway No. 21.

2. This possible development is being studied by the United States Bureau of Reclamation. The dam would be an earth-fill structure 350 feet high, having a top elevation of 4,415 and a top length of about 2,000 feet. Full pool would be at elevation 4,400 with a gross storage of 360,000 acre-feet. Regulation of the reservoir between elevations 4,400 and 4,200 would provide 300,000 acre-feet of usable storage. A concrete-lined pressure tunnel, 38,000 feet long and 8 feet in diameter, would serve a powerplant discharging into the existing Hungry Horse Reservoir. The mean headwater elevation would be 4,320 and the tail-water of the powerplant would be at elevation 3,570, giving 750 feet of gross head and approximately 650 feet of net head. With a constant capacity of 475 cubic feet

per second, the power developed at the site at 80 percent efficiency would be 21,000 kilowatts.

3. Permanent access to the powerhouse would be provided by improving the existing Forest Service road along the right bank of Hungry Horse Reservoir. Access to the dam would be by constructing about 5 miles of new road upstream from United States Highway No. 2.

4. The reservoir would inundate 2,600 acres of forest-covered land in the Flathead National Forest. Except for Forest Service trails, there are no improvements in the area.

5. *Estimated costs and benefits.*—Studies of this project have been of a reconnaissance nature and estimated costs and benefits are tentative subject to revision when additional data are available. The total project construction cost is estimated to be about $40 million, based on January 1, 1956, price levels. Project benefits would be power and flood control. Power at site would have an annual value of about $730,000. Downstream power benefits would amount to about $2,100,000 for plants now existing, under construction or proposed. Flood-control benefits are estimated to be about $180,000 annually. A comparison of total benefits of $3,010,000 with project annual costs of $1,750,000 indicates a benefit-to-cost ratio of about 1.7.

6. *Project accomplishments.*—Three hundred thousand acre-feet of usable storage would provide 21,000 kilowatts of at-site power and about 107,000 kilowatts of downstream power. The diversion of this storage into the Hungry Horse Reservoir would increase the effectiveness of this existing project. In addition, this storage would have downstream flood-control benefits.

7. *Possible problems or objections.*—The effect of the Spruce Park Reservoir on fish in the Flathead River would be of concern to fishery interests. Further studies of the effect on fish and game will be necessary to arrive at a solution to these problems. The river through this area is adjacent to the geological fault, known as the Roosevelt Fault. Special foundation studies and design are required for any proposed structure.

NARRATIVE REPORT—ENAVILLE PROJECT, COEUR D'ALENE RIVER, IDAHO

1. *Project description.*—The Enaville project on the Coeur d'Alene River at mile 37.2 is immediately upstream from the village of Enaville, Idaho. The proposed dam would be an earth-fill structure about 290 feet high, having a top elevation of 2,440 and a top length of 1,340 feet. Full pool would be at elevation 2,430, providing gross storage of 1,012,000 acre-feet and usable storage of 805,000 acre-feet for a 50-percent drawdown. A chute-type spillway is considered most suitable. For the spillway design flood of 120,000 cubic feet per second a surcharge of 1.5 feet would be required, with a maximum pool at elevation 2,431.5 feet.

2. The powerhouse would be located on rock on the right bank downstream from the spillway stilling basin. Two vertical shaft Francis turbines, with generators of 32,500 kilowatts each (nameplate capacity), would be served by penstocks leading from a tunnel 24 feet in diameter which would serve for diversion during construction. Length of tunnel required for power service would be about 2,000 feet with penstocks not more than 100 feet long.

3. Permanent access to the powerhouse would be provided by construction of 0.75 mile of railroad from existing Union Pacific Railroad below Enaville Junction. A roadway on the railroad grade would also serve the powerhouse. Access to the dam would be provided by existing roads during construction and by relocation of an existing secondary road over the top of the dam. The existing roads connect with United States Highway No. 10 a short distance below the dam site.

4. River diversion during construction would be by a tunnel that would later serve both the powerhouse and two high-pressure outlets discharging into the spillway stilling basin. Tunnel capacity would be adequate to provide reasonable assurance against flooding incomplete work during construction.

5. The reservoir would inundate 9,000 acres of the sparsely settled valley having about 52 miles of secondary and United States Forest Service roads, approximately 24 miles each of powerline and United States Forest Service telephone line, 2 small villages, 100 residences, and 8 other principal buildings.

6. *Estimated costs and benefits.*—The costs and benefits are based on preliminary investigations and are tentative pending more detailed studies. On the basis of January 1956 price levels, the construction cost of the project is

estimated to be $41,630,000. Annual costs amount to $1,934,000. Project primary benefits are power and downstream flood control. Power at site would have an annual value of $907,000. Downstream power benefits would be $2,495,000 for plants now existing, under construction, and proposed. Flood-control benefits along the lower Columbia River are estimated to be $300,000 annually. Local flood-control benefits which may amount to as much as $100,000 have not been evaluated or included in the total benefits. Comparison of total benefits of $3,702,000 with the annual cost of $1,934,000 gives a benefit-to-cost ratio of 1.91.

7. *Project accomplishment.*—The Enaville project with 805,000 acre-feet of usable storage would provide a significant addition to the power supply of the Northwest by adding a potential 176,000 kilowatts downstream power and 35,600 kilowatts of prime power at-site. In addition, this storage would provide substantial downstream flood-control benefits and may have important beneficial effects on irrigation. Recreational opportunities would be provided through creation of the lake back of Enaville Dam, which would serve as a recreational area convenient to the more heavily populated areas on the South Fork of the Coeur d'Alene River.

8. *Possible problems and objections.*—There are no known problems or objections of major significance concerning the Enaville project. No mining properties of present importance are in or contiguous to the dam or reservoir. Logging is underway in the area but existing roads could be relocated to satisfy forestry requirements. The proposed project was presented to representative interests, including mining interests, in a meeting at Spokane on February 3, 1956. Reactions obtained in this meeting indicate that the Enaville project would be favorably received by the public. Further studies of the effect of the project on fish and wildlife are necessary to solve any problems of this nature.

NARRATIVE REPORT—LIBBY DAM PROJECT, KOOTENAI RIVER, MONT.

1. *Project description.*—The site for the proposed Libby Dam is on the Kootenai River at mile 217, about 15 miles upstream from the town of Libby and 1.5 miles upstream from the mouth of the Fisher River. The dam would be a straight concrete gravity structure with a maximum height of about 400 feet above bedrock, having a top elevation of 2,480 and a top length of 2,700 feet. Three low earth-fill dams having a total length of 3,200 feet and a maximum height of 120 feet would be constructed across low saddles on the left bank. Full pool would be at elevation 2,459, providing gross storage of 5,985,000 acre-feet and usable storage of 5,010,000 acre-feet at 50 percent drawdown. A gross head of 344 feet would be available between the headwater elevation of 2,459 and the mean tailwater elevation of 2,115. The spillway would be a gate controlled, concrete ogge weir with stilling basin capable of passing a spillway design flood of 280,000 cubic feet per second.

2. The powerhouse would be located at the toe of the dam on the left bank. The initial powerhouse installation would include 6 vertical shaft Francis turbines, with generators of 100,000 kilowatts (nameplate capacity) for an initial installed capacity of 600,000 kilowatts. The ultimate powerhouse installation is planned for 8 units, for an ultimate installed capacity of 800,000 kilowatts.

3. Montana State Highway No. 37 and the Great Northern Railway would provide access to the project.

4. The reservoir would cover 47,800 acres, extending for 95 miles; the upstream 42 miles of the reservoir covering 17,600 acres, would be in Canada. The reservoir area is in a narrow valley that is sparsely settled. In the United States' portion of the reservoir about 80 miles of the main line of the Great Northern Railway, a State highway, county, and Forest Service roads would require relocation. A few very small communities and farms would also be displaced. The Canadian portion of the reservoir includes a few small communities, farms, and some secondary roads; it would also be necessary to raise the grade of branch line railroads and relocate highways for short distances.

5. *Estimated costs and benefits.*—At July 1, 1955, price levels, the total construction cost is estimated to be $265,756,000. Annual costs for the project would amount to $12,795,000. Project benefits are primarily power and flood control, with incidental benefits for recreation and navigation. Power benefits at site would have an annual value of $7,884,000. Downstream power benefits for Federal plants in the United States now existing or under construction would have an annual value of $11,280,000. The total power benefits at site and downstream would be $19,164,000. The estimated annual benefits, other than for power,

include $3,116,000 for flood control, $70,000 for recreation, and $21,000 for navigation. Comparison of the total annual benefits of $22,371,000 with the annual cost of $12,795,000 provides a project benefit-to-cost ratio of 1.75.

6. *Project accomplishment.*—Libby Dam project, with 5,010,000 acre-feet of usable storage, is a key project in the main control plan of the Columbia Basin for both flood control and generation of hydroelectric power. It is the most economical of the authorized multiple-purpose projects in the Columbia Basin, on which construction has not yet been started, and no other energy comparable to the low cost of Libby Dam hydroelectric power is available in the Northwest. The critical power shortage experienced in the Northwest from September 1952 to January 1953, which eliminated all interruptible power and 10 percent of the firm power, could have been prevented if Lbby Lam had been in operation at that time.

7. Flood protection along the lower Columbia River main stem, and for the 48,800 acres of highly productive agricultural lands in the Kootenai Valley in the United States and in Canada, would be provided through the upstream storage provided by Libby Dam. This storage could have prevented the disastrous flooding in the Kootenai Valley that affected 32,000 acres in 1948 and 6,600 acres in 1954. The damages and costs of flood fighting, in the United States reach of the Kootenai River alone, for the 1954 flood amounted to $1,400,000. The reservoir would provide incidental benefits to recreation and the later release of impounded floodwater during periods of low flow would provide navigation benefits on the lower Columbia River main stem.

8. *Known problems and objections.*—The Kootenai River is an international stream and Libby Dam would create a reservoir at a normal elevation of 2,459, backing waters of the Kootenai River 42 miles into Canada. This reservoir level was recommended in an interim report to the International Joint Commission by the Commission's study group, the International Columbia River Engineering Board. Following congressional approval of Libby Dam in 1950, an application for the project was officially submitted by the United States Government to the International Joint Commission in January 1951. In April 1953, the United States application for approval of Libby Dam was withdrawn from the International Joint Commission in order to permit redraft of the application to meet domestic requirements. In May 1954, the State Department resubmitted the application of the United States to the International Joint Commission, requesting approval for construction of Libby Dam at mile 217. This project now awaits approving action by the International Joint Commission.

NARRATIVE REPORT—LONG MEADOWS PROJECT, YAAK RIVER, MONT.

1. *Project description.*—The Long Meadows project is on the Yaak River at mile 30. The dam would be an earth-fill structure about 215 feet high, having a top elevation at 3,125 and a top length of 3,000 feet. Full pool would be at elevation 3,100 providing gross storage of 726,000 acre-feet. Usable storage of at least 450,000 acre-feet would be available for flood control and power. A gross head of 190 feet would be available between the headwater elevation of 3,100 and a minimum tailwater elevation of 2,910. An ungated side channel spillway would pass the spillway design flood of 20,000 cubic feet per second with maximum surcharge pool at elevation 3,114.

2. The powerhouse would be located near the toe of the dam on the left bank. Two vertical shaft Francis turbines with generators of 10,000 kilowatts each (nameplate rating) would be installed in the powerhouse.

3. Access to the dam would be provided by an existing Forest Service road on the right bank of the river. This road would be improved for about 25 miles between the dam site and its junction with Federal Highway No. 2 to the south. Rail facilities of the Great Northern Railway are available at Troy, Mont., a distance of 40 miles from the site.

4. River diversion during construction would be by a tunnel 20 feet in diameter that would later contain the power penstocks.

5. *Reservoir area.*—The reservoir would inundate 7,700 acres and would extend upstream for 19 miles to a point about 4 miles from the Canadian boundary. It occupies a widened part of the Yaak River Valley which is partially covered by timber. The estimated acreage of merchantable timber to be removed includes 4,800 acres of privately owned timber and 2,600 acres of Government-owned. The valley is sparsely settled and not highly improved except for the county and Forest Service roads into the area. However, the cantonment area of the Yaak Air Force installation would be below pool level, and would require

relocation to a higher level. Telephone facilities to the military installation would require relocation from within the reservoir area.

6. *Estimated costs and benefits.*—Costs and benefits are estimated from very limited data and are subject to verification when more complete field data have been obtained. At January 1956 price levels and with a 3-year construction period, the total construction cost is estimated at $18,500,000. Annual costs for the project would amount to $1,161,000. Benefits of the project are primarily power and flood control. Power at site would have an annual value of $342,000. Downstream power benefits would be $1,241,000 for plants now existing, under construction, and proposed in the United States. Flood-control benefits along the lower Columbia River are estimated to be $216,000. The project storage would also provide flood control benefits to the Kootenai Flats Area downstream along the Kootenai River in Idaho. These local benefits have not been evaluated or included as benefits in the preliminary study. The comparison of total benefits of $1,799,000 with the project annual cost of $1,161,000, gives a benefit-to-cost ratio of 1.55.

7. *Project accomplishment.*—The Long Meadows project would provide an important addition to Northwest power by adding 63,000 kilowatts of downstream power and 12,000 kilowatts of prime power at site. The construction of a storage project at Long Meadows would make it economically feasible to develop run-of-the-river plants for the generation of power at several favorable sites along the Yaak River downstream from Long Meadows. In addition, this storage would provide flood-control benefits, both in the Kootenai Flats area downstream along the Kootenai River in Idaho and along the lower Columbia River.

8. The reservoir behind the Long Meadows Dam would provide a recreational area which would add to the use of the area during the summer season.

9. *Possible problems and objections.*—The relocation of the cantonment for the Yaak Air Force Base, an important military installation, is a major problem created by the Long Meadows project. Relocation of the base would require additional access road construction and relocation of the communication lines to the site.

10. The existing logging operations in the area depend on present access roads for efficient operation. These roads could be relocated to avoid any adverse effect on this industry. Pasture land in the reservoir area has only seasonal use because winters are severe and the land is snow-covered most of the winter months.

11. Further studies will be made of the effect of the project on fish and wildlife to solve any problems of this nature.

NARRATIVE REPORT—WENATCHEE RIVER AND TRIBUTARIES, WASHINGTON

1. *Project description.*—Public Utility District No. 1 of Chelan County, Wash., operating under a preliminary permit from the Federal Power Commission for project No. 2151, is currently studying the hydroelectric development of the Wenatchee River and its tributaries. The permit, issued June 3, 1954, extends for a period of 36 months.

2. As described in the Federal Power Commission application, the proposed project, to be known as the Wenatchee hydroelectric project, would consist of—

(*a*) A rock-fill dam in the Chiwawa River creating a reservoir with about 350,000 acre-feet of useful storage at elevation 2,250 and a powerplant at the dam site with 10,000 kilowatts of installed capacity.

(*b*) A regulating dam at the outlet of Lake Wenatchee to maintain the lake during the summer recreation season at the maximum experienced elevation of 1,880 and providing for use during the remainder of the year of approximately 24,800 acre-feet of storage with 10 feet draw down.

(*c*) A dam in the Wenatchee River upstream from the confluence of Chiwaukum Creek, creating Tumwater Reservoir with water surface at about elevation 1,750, a tunnel and penstock extending approximately 6 miles to a powerplant of 135,000 kilowatts installed capacity, near the town of Leavenworth on Chumstick Creek just above its confluence with the Wenatchee River.

3. *Status.*—Studies of flood-control storage possibilities in this watershed in connection with the 531 review have been deferred until the project sponsor has formulated the plan of development for projects covered by this Federal Power Commission preliminary permit No. 2151. Discussions have been held with the project sponsor and assurance has been given that findings of these studies will be available. Following availability of the firm plan of development from the project sponsor, the necessary studies would be initiated for determination of possibilities of modifying the plan to provide additional storage for flood control.

NARRATIVE REPORT—NIGHTHAWK PROJECT, SIMILKAMEEN RIVER, WASH.

1. *Project description.*—An irrigation project on the Similkameen River at river mile 15.2 about 2½ miles below Palmer Creek is being studied by the United States Bureau of Raclamation. A dam at this site would provide 32,000 acre-feet of storage for a pool elevation of 1,155 and 106,000 acre-feet for a pool at elevation of 1,174, the latter backing water to the Canadian boundary. The reservoir would inundate a branch line of the Great Northern Railway, a highway, and hayfields and pasturelands in the valley bottom.

2. *Project accomplishments.*—The project would provide storage to supplement existing irrigation supplies and to serve new irrigation developments.

3. *Possible problems and objections.*—Limited field explorations are being made by the Bureau to determine physical feasibility. The flooding of the valley bottom lands or a change in the levels of Palmer Lake may be objectionable to local residents.

NARRATIVE REPORT—GRAND COULEE DAM PROJECT, COLUMBIA RIVER, WASH.

1. *Project description.*—The modification of 60 outlet gates (3 tiers, 20 outlets in each tier) in Grand Coulee Dam to increase the usable flood storage is under study. Flood-control storage now effective at this project is 1,100,000 acre-feet. Improvements to permit full use of the outlets would make 4,100,000 acre-feet available for flood storage, an increase of 3 million acre-feet.

2. A raise in the height of Grand Coulee Dam is another possibility which is being considered. Current studies indicate that a raise of 2 feet by using flash boards may be feasible. A further increase in dam height requires physical changes in the structure resulting in major design and flowage problems.

3. *Status.*—Use of the outlet gates to vacate reservoir storage capacity in accordance with flood forecasts is currently under consideration by the United States Bureau of Reclamation. Special prototype tests on use of the lower tier of 20 outlet gates will be performed during the 1956 high-water season, so that physical feasibility on use of these lower outlets can be established. Possibilities of raising the height of the dam are currently under study.

NARRATIVE REPORT—LOLO CREEK PROJECT, LOLO CREEK, MONT.

1. *Project description.*—The United States Bureau of Reclamation has made preliminary investigations of a storage project at a site about 4 miles upstream from the town of Lolo, Mont., and United States Highway No. 93. The estimated annual runoff at the site from 3 years of record is about 135,000 acre-feet with a low flow of 108,000 acre-feet recorded in 1953.

2. The project given consideration was an earth-fill dam about 235 feet high with a top elevation of about 3,590. The reservoir would be about 6 miles long and have a gross storage of 135,000 acre-feet for pool elevation of 3,570. Water would be conveyed by a canal about 12 miles in length along the left side of the valley to a site on the Bitterroot River where it would be delivered through a steel penstock to powerhouse located along the Bitterroot River. The gross head between the headwater elevation of 3,570 and a tail-water elevation of 3,175 would be 395 feet.

3. There are 2,300 acres of irrigated land below the dam site now receiving water from Lolo Creek. The total water rights of these irrigations total 150 cubic feet per second. With allowances for irrigation withdrawals and minimum winter flows, an estimated 103,500 acre-feet would be available for power. In the low-water year of 1953, only 77,000 acre-feet would have been available for power use.

4. The principal development affected by the reservoir is an improved Federal-aid highway along the stream. This highway would require relocation to a route lying above the reservoir pool.

5. *Basis for elimination.*—Estimates by the Bureau of Reclamation show that the total construction cost of this project would range from $10 million to $20 million. It is a fringe project with the cost very high for the small amount of storage provided particularly in low-water years. Preliminary information indicates that the public may be unfavorable toward this project. In view of these findings, further study of this project is not considered to be warranted at this time.

NARRATIVE REPORT, ATKINS PROJECT, ROCK CREEK, MONT.

1. *Project considered.*—A project at the Atkins site, river-mile 43, on Rock Creek, Mont., has been considered. The dam would be a concrete structure, 173 feet high with a top elevation of 5,070. Full pool at elevation 5,060 would provide 140,000 acre-feet of gross storage.

2. *Basis for elimination.*—The Montana State Department of Fisheries has indicated that Rock Creek is an important sports fishing stream and that the State is unfavorable to the construction of any dams in this watershed. In view of this opposition and the fact that only a limited amount of storage is available on this stream, further studies of this project have been discontinued.

NARRATIVE REPORT, OVANDO PROJECT, BLACKFOOT RIVER, MONT.

1. *Projects considered.*—The potentialities of the upper Blackfoot River in the vicinity of Ovanda were studied during the preparation of House Document 531. Dam sites considered in these studies are summarized as follows:

Dam site	Dam height (feet)	Dam length (feet)	Gross storage (acre-feet)
Lower Ovando (river-mile 47)	210	430	380,000
Upper Ovando (river-mile 52)	180	1,250	216,000

2. *Basis for elimination.*—The Ninemile Prairie project now under study by the United States Bureau of Reclamation would control the flow of the Blackfoot River. The development of storage upstream from the Ninemile project would, therefore, provide little additional flood control or downstream power benefits. In view of these facts, further study of these projects is not considered to be warranted at this time.

NARRATIVE REPORT, LITTLE BITTERROOT RIVER, MONT.

1. *Project considered.*—A preliminary study was made of a storage project along the Little Bitterroot River at a site about 0.6 mile upstream from its mouth. The dam would be an earth-fill structure, about 130 feet high with a top length of 1,350 feet. Full pool at elevation 2,700 would provide 92,000 acre-feet of gross storage, of which 60,000 acre-feet would be usable for power with a drawdown of 22 feet. The spillway would be reinforced concrete structure with 2 gates capable of passing a flow of 7,500 cubic feet per second. The powerhouse would be located on the left bank near the toe of the dam and served by a steel penstock. The gross head between a headwater elevation of 2,700 and a minimum tailwater water elevation of 2,575 would be 125 feet. The installed capacity would be 1,360 kilowatts for at-site power at a 30-percent load factor.

2. *Estimated costs and benefits.*—Studies of this project are of a reconnaissance nature. Estimated costs and benefits are tentative and are subject to revision when additional data are available. The estimated total construction cost of the project is $5,214,000. The annual benefits would be about $240,500 for power at site and downstream. A comparison of project annual costs of $215,700 with the annual benefits gives a benefit-to-cost ratio of 1.13.

3. *Basis for elimination.*—This development is a fringe project with limited storage and power and a benefit-to-cost ratio of about unity. Furthermore, the development of a storage project at Buffalo Rapids No. 4 on the Flathead River would inundate this site. In view of these findings, further study of this project is not warranted.

NARRATIVE REPORT, SWAN RIVER PROJECT, SWAN RIVER, MONT.

1. *Project description.*—A project on the Swan River about 2 miles upstream from Flathead Lake, Mont., was studied. The dam would be an earth-fill structure about 90 feet high, having a top length of about 900 feet and a top elevation of 3,080. Full pool would be at elevation 3,070, providing a gross storage of 400,000 acre-feet and a usable storage of 320,000 acre-feet for a drawdown of 30 feet. A concrete overflow spillway with a capacity of 43,000 cubic feet per second controlled by 3 tainter gates would be founded on rock in the right bank. A powerhouse with an installed capacity of 12,000 kilowatts would be located

on Flathead Lake about 1½ miles downstream from the dam. The tail-water elevation would range from 2,883 to 2,893 feet. The static head would thus vary from 147 to 187 feet.

2. The reservoir would inundate about 20,000 acres of valley and benchland lying downstream from Swan Lake. The reservoir area consists of approximately 15,000 acres of brush and wooded area, with scattered small lakes and ponds, and about 5,000 acres of developed farmland. The reservoir would be controlled to a maximum elevation of 3,070. This is 1½ feet below the maximum stage of 3,071.5 feet for Swan Lake during the high-water period of 1948.

3. *Estimated costs and benefits.*—On the basis of a preliminary study, the total construction cost based on January 1956 price levels is estimated at $28 million. Annual costs for the project are $1,240,000. The annual benefits would be approximately $2 million for power and $190,000 for flood control. A comparison of total benefits of $2,190,000 with project annual costs of $1,240,000 gives a benefit-to-cost ratio of 1.7.

4. *Basis of elimination.*—The drawdown of the reservoir for power and flood control would expose large areas of mud flats and stagnant ponds along the shallow shoreline of reservoir downstream from Swan Lake. A farm community having about 140 farm residences, 2 schools, and 1 church with related transportation and communication facilities would be inundated by the project. In view of these displacements and conditions which make the project unacceptable to the public, further studies of this development are not warranted at this time.

NARRATIVE REPORT—STILLWATER RIVER PROJECT, MONTANA

1. *Projects considered.*—Preliminary studies were made of minor storage developments in the Stillwater River watershed on the basis of a field reconnaissance and limited available data. The findings of these studies are described herein.

2. *Talley Lake dam site.*—The dam located at the lake outlet would be a concrete structure, 40 feet high, with a crest length of 385 feet. Full pool at elevation 3,368 would provide 45,000 acre-feet of usable storage which would be above the existing lake elevation of 3,340. An overflow spillway section would pass a design flood of 6,000 cubic feet per second. A powerhouse on the Stillwater River would be served by a conduit about 18,500 feet in length. The gross head developed between a headwater elevation of 3,368 and a tail-water elevation of 2,950 would be 418 feet. The installed at-site power would be 5,650 kilowatts at 30-percent load factor. The undeveloped shoreline of Talley Lake would be inundated by the reservoir.

3. *Olney dam site.*—The Olney dam site is located on the Stillwater River about 3 miles downstream from the outlet of upper Stillwater Lakes. The dam would be an earth-fill structure, 100 feet high, having a top length of 1,050 feet. Full pool at elevation 3,195 would provide 37,000 acre-feet of gross storage of which 20,000 acre-feet would be usable for power with a drawdown of 20 feet. An overflow spillway section would pass a design flood of 12,000 cubic feet per second. Power would be developed at the site under a gross head of 115 feet between a headwater elevation of 3,195 and a tail-water elevation of 3,080. The installed at-site power would be 1,000 kilowatts at 30-percent load factor. Approximately 4 miles of the main line of the Great Northern Railway would require relocation to a route above the reservoir.

4. *Depew dam site No. 1.*—Depew dam site No. 1 is located on the Stillwater River about 4½ miles downstream from the outlet of lower Stillwater Lake. The dam would be an earth-fill structure, 225 feet high, having a top length of 5,600 feet with an overflow spillway which would pass a design flood of 12,000 cubic feet per second. Full pool at elevation 3,190 would provide 400,000 acre-feet of gross storage of which 120,000 acre-feet would be usable for power with a drawdown of 15 feet. Power would be developed at the site under a gross head of 210 feet between a headwater elevation of 3,190 and a tail-water elevation of 2,980. The installed capacity at-site would be about 7,700 kilowatts at a 30-percent load factor. Eleven miles of the main line of the Great Northern and 11 miles of United States Highway No. 93 would require relocation to a route lying above the reservoir.

5. *Depew Dam site No. 2.*—The United States Bureau of Reclamation has given consideration to a dam site located on the Stillwater River about 6.5 miles below the lower Stillwater Lakes. A dam at this site would be 115 feet high with a crest length of 5,000 feet. Full pool at elevation 3,090 would have a gross storage of 150,000 acre-feet. The reservoir would inundate 5,100 acres of

a forest-covered area and require the relocation of about 9½ miles of United States Highway No. 93. The main line of the Great Northern Railway which traverses the left side of the reservoir would not require relocation.

6. *Estimated costs and benefits.*—A comparison of annual benefits and costs for power projects at the Talley Lake, Olney, and Depew No. 1 dam sites revealed a benefit-to-cost ratio of less than unity. Costs and benefits for a project at the Depew No. 2 site, which was considered by the United States Bureau of Reclamation were not estimated.

7. *Basis for elimination.*—On the basis of current preliminary studies, a favorable economic basis has not been found for projects in this watershed. In view of these findings and the fact that any development would be limited in both storage and power, further studies are not believed to be warranted at this time.

NARATIVE REPORT—ST. JOE RIVER PROJECT, IDAHO

1. *Projects considered.*—Headwater storage projects at four alternate sites on the St. Joe River above Avery, Idaho, were given consideration. To obtain any significant amount of storage, a dam of a height in excess of 400 feet would be required because of the steep gradient of the stream and the narrow river valley. Preliminary investigations of these sites revealed a lack of economic feasibility.

2. The main line of the Chicago, Milwaukee & St. Paul Railroad is located along the St. Joe River, upstream from Avery, Idaho, and thence along the North Fork to a tunnel into the Clark Fork watershed. Any storage project developed in this reach of the stream would require a major railroad relocation at excessively high cost. This high relocation cost precludes development of storage along the North Fork. Development of a storage project along the main stem of the St. Joe below Avery might be economically feasible provided that a suitable dam site can be located. Such a project would probably not be acceptable to the public because of the major relocation problems and the displacement of existing developments in the river valley.

3. *Basis for elimination.*—Preliminary investigations indicated that the development of storage projects on the St. Joe above Avery and on the North Fork were not economically feasible. In view of the major railroad relocation required for a storage project along the main stem of the St. Joe below Avery, a development in this reach of the stream is not considered to be acceptable to the public.

NARRATIVE REPORT—CURLEW PROJECT, KETTLE RIVER, WASH.

1. *Project description.*—A storage project at the Curlew site, river mile 64 on the Kettle River and about 3 miles downstream from the town of Curlew, Wash., has been given consideration. The dam would be an earth- and rock-fill structure about 140 feet high, having a top elevation of 1,880, and a top length of 1,200 feet. Full pool would be at elevation 1,870, backing water to the international boundary to form a reservoir with a gross storage of 165,000 acre-feet. Usable storage of about 150,000 acre-feet would be available for flood control and downstream power. The spillway would be a concrete-lined chute in rock around the left abutment with a capacity of 60,000 cubic feet per second. Diversion of the stream during construction would be through a 20-foot-diameter, concrete-lined tunnel 1,500 feet long in the left abutment. The reservoir would inundate 5.5 miles of a branch line of the Great Northern Railway, 4 miles of State Highway 4A, 13 miles of improved local roads, and 15 miles of unimproved local roads, 12 miles of power-transmission line, 12 miles of telephone line, the town of Curlew, a lumber mill, and some farmhouses.

2. *Estimated costs and benefits.*—Costs and benefits were estimated from limited data and are approximate. The total construction cost is estimated at $10,361,000 with no power at the site. Annual costs for the project are $421,000. Annual benefits are estimated to be $553,000, which include $478,000 in downstream power benefits and $75,000 in flood-control benefits. A comparison of annual benefits with annual costs gives a benefit-to-cost ratio of 1.3.

3. *Basis of elimination.*—The project would inundate the town of Curlew together with a railroad, highways, powerlines, and farmhouses and would have a major impact on the local economy. Public acceptance of the project does not appear possible because of these adverse local effects. In view of these findings, further studies of this site are not considered to be warranted at this time.

NARRATIVE REPORT—MEADOW CREEK PROJECT, MOYIE RIVER, IDAHO

1. *Project description.*—A storage project at the Meadow Creek site at river mile 10.9 on the Moyie River, Idaho, has been given consideration. The dam would be an earth- and rock-fill structure about 265 feet high, having a top elevation at 2,635, and a top length of 1,150 feet. Full pool would be at elevation 2,620, which is below the river elevation at the international boundary, and would provide for gross storage of 323,000 acre-feet of which 320,000 acre-feet could be considered usable for power and flood control. A concrete-lined open channel spillway with a design flood capacity of 25,000 cubic feet per second would be located in a saddle of the east abutment. A 22-foot-diameter diversion tunnel for use during dam construction and ultimately for the generation of power, would pass through the west abutment. The reservoir, with an area of 4,350 acres, would require the relocation of 23.5 miles of Spokane International Railroad and 17.5 miles of United States Highway 95.

2. *Estimated costs and benefits.*—Based on preliminary studies the project is estimated to cost $28 million. The annual benefits would be about $1,100,000 for power and $200,000 for flood control. A comparison of the annual cost of $1,360,000 with the total project benefits of $1,300,000 indicates a benefit-to-cost ratio of unity.

3. *Basis for elimination.*—On the basis of the preliminary study a project having a pool entirely within the United States has a benefit-to-cost ratio of about unity and is, therefore, a fringe project which would probably not be developed within 25 years. Full development of the Moyie River by a project having a pool extending into Canada would have more favorable economic justifications. In view of the current Canadian position with regard to storage in Canada, favorable consideration of such a development is considered improbable at this time. In view of these findings, and the fact that a major relocation of the Spokane International Railroad would be required, detailed study of this project is not considered to be warranted at this time.

[From the Vancouver (British Columbia) Province of April 23, 1956]

COLUMBIA RIVER CRISIS: 1. THE PROBLEM—THE CLASH OF THE COLUMBIA—WILL CANADA OR UNITED STATES GROW?

(By Peter Inglis)

(First of three articles)

SEATTLE.—Summing up after nearly a full day of debate, Mr. Leon J. Ladner, Q. C., of Vancouver, brought it down from the legal stratosphere to its earthy essentials:

"Competition for power is really the issue."

And, sitting on the sidelines, President Norman A. MacKenzie, of the University of British Columbia, murmured to a neighbor an even tenser summary:

"What's it's really about it: Who grows?"

Mr. Ladner, Dr. MacKenzie, and a half-dozen other Canadian legal experts had come down to the University of Washington late last week for a Pacific Northwest regional meeting of the American Society of International Law to thrash out a number of the legal aspects of Canadian-American relations and, in particular, what the program billed as "Diversion of Columbia River waters." (Actually it went a good deal further than that.)

The United States State Department and the Canadian Department of External Affairs took the discussion seriously; both had asked for a verbatim transcript, and a court reporter recorded it all.

If you want to regard it strictly as a debate, you can say that the Canadians won hands down—chiefly because they had done their homework better than most of their American colleagues.

But you could argue that it was something a good deal bigger than a contest of opinions. You might even claim, without exaggerating much, that it was a first serious step toward creating the atmosphere for an amicable settlement of a situation in which, in the words of Senator Richard L. Neuberger, of Oregon, in a recent report to the Committee on Insular and Interior Affairs of the United States Senate, "failure to reach agreement on a mutually beneficial program * * * would threaten the gravest crisis in modern United States-Canadian relations, as well as incalculable economic loss to both countries."

Certainly at the start both sides were firmly entrenches in fixed positions behind their respective interpretations of international law but by evening were approaching a meeting on the common ground of the good sense and friendship of their two countries.

At this point it might be well to take a look at the background of the Columbia River issue, a look which some of the American participants in the discussion had not taken closely enough (one of them even seemed to think that the proposal of the Kaiser interests to generate power on the Columbia in British Columbia for use in an aluminum smelter in the United States was still in the cards; he was unaware that it had been killed stone-cold dead long since by the Canadian Parliament's famous bill 3).

Very much condensed, the background goes like this:

The United States today is drawing some 7 million kilowatts, or about 9,300,000 horsepower, of hydroelectric power from the Columbia Basin. It expects to need about double that amount within 10 years.

The American investment in existing powerplants in the basin is about $1,500,000,000. New plants now under construction represent another $1 billion, and a further $2 billion worth are on the drawing boards, with the funds already authorized.

The plants now existing and under construction represent just about the full potential of the river as it is today. The projected construction requires a system of upriver storage to retain the surplus flow during floods and the months of heavy runoff (today wasted out to sea) and to release it during the seasons of lower water.

One of the principal means of storage would be the projected Libby Dam on the Kootenai River in northwestern Montana. The Kootenai starts life as the Kootenay in British Columbia, runs south to the international border; loops through Montana and the northeastern corner of Idaho, crosses back into British Columbia (picking its terminal "y" up again) and eventually joins the Columbia at Castlegar, some 20 miles north of the boundary. The dam would back a vast volume of water into Canada; the flooding would be 150 feet in depth at the boundary.

The water thus stored would drop only a modest 360 feet through the existing small dams on the west Kootenay in Canada, but would then fall through a head of nearly 1,300 feet on its way through the Columbia River dams in the United States. That is to say, each ton of water originating in Canada and stored in Canada would release nearly four times as much energy in the United States as in Canada.

The Libby Day project, authorized by the United States Congress, was put before the International Joint Commission to secure the necessary Canadian approva. The Canadian Section of the Commission proposed that the United States pay Canada substantially for the upstream storage, here and elsewhere, from which the United States would derive great downstream benefits. The United States Section of the Commission claimed the Canadian figures were much too high.

Failing agreement on American payment for what was, in effect, Canadian power potential, the Chairman of the Canadian Section, Gen. A. G. L. McNaughton, who is also an engineer, came up with a proposal of his own for Canadian use of that potential.

He proposed to divert a large part of the flow of the headwaters of the Kootenay into Columbia Lake from which the Columbia River rises; to dam the Columbia either at Downie Creek or, more probably, at Little Dalles, just north of Revelstoke, and to divert about one-fourth of its flow (augmented by the Kootenay) through a 7-mile tunnel under the watershed into the Fraser Basin, where it would flow through Shuswap Lake, the South Thompson, and the Thompson into the Fraser.

This would add between 2 and 3 million horsepower to the power potential of the Fraser Basin and would be of immense value in meeting British Columbia's fast-increasing energy requirements. (In its submission to the Gordon Commission on Canada's economic prospects, the Province estimated that its power consumption would increase by 457 percent between 1955 and 1975.)

The American members of the International Joint Commission, under Len Jordan, former Governor of Idaho, argued that this project would ruin the downstream American development of the Columbia. The Canadians maintained that it would not reduce the flow across the international border. (That the diversion of the Kootenay would make the Libby Dam project impossible was incontestable, but outside the mainstream of argument.)

There was an element of a certain wry humor in this situation. On the one hand the Americans were arguing that in the matter of storage upstream Canadian water was of relatively little importance—indeed, they launched a fairly intensive propaganda campaign, which still continues, to persuade Canadians that cheapening steam power and potential atomic power would make the water become steadily less valuable, so they had better let it go now. On the other, they contended that the diversion of the same water would ruin some $2 billion of power planning.

The deadlock in the International Joint Commission became so serious that Prime Minister St. Laurent raised it at his White Sulphur Springs meeting with President Eisenhower a month ago. On April 9 he said in the House of Commons that "there was a feeling that the Chairmen of the two Sections (of the Commission) had publicly expressed views so diametrically opposed to each other that there was little probability of their making the kind of progress we would hope would be made" and that in his talks with Mr. Eisenhower "it was left that the matter would be further discussed between our Department of External Affairs and the Department of the Secretary of State."

Where do we go from here? To an agreed solution or to the International Court of Justice at The Hague? I shall discuss that choice tomorrow.

[From the Vancouver (British Columbia) Province of April 24, 1956]

COLUMBIA RIVER CRISIS: 2. THE LAW—A DISTASTEFUL TREATY THAT REBOUNDED

(By Peter Inglis)

(Second of three articles)

SEATTLE.—I wrote yesterday that there was a certain wry humor in the American position toward Canada in the Columbia River argument—that on the one hand the river's water, when stored on Canadian soil for downstream use in the United States, is of trivial value; on the other, when a Canadian proposes to divert some of it into the Fraser it becomes of critical necessity to American power development.

There is a touch of the same sort of irony in the origins of the Boundary Waters Treaty of 1909, the hub around which the legal argument revolved, sometimes acrimoniously, in the Canadian-American roundtable debate at the Pacific Northwest regional meeting of the American Society of International Law here late last week.

Article II of the act, which is its core in this instance, reads in part:

"Each of the high contracting parties reserves to itself or to the several State governments on the one side and the Dominion or provincial governments on the other * * * the exclusive jurisdiction over the use and diversion, whether temporary or permanent, of all waters on its side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channel of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs. * * *"

The irony is that the first section, which repeats the so-called Harmon doctrine that a country has absolute control of everything within its borders, was put in at the insistence of the United States Government and against considerable Canadian resistance; the second, providing legal recourse against the effects of this policy, was a reluctant sop from the United States to Canada.

Today, in the Columbia case, the United States is loudly protesting a proposal to divert a part of the river's flow in Canada, and American legal experts at the roundtable here were talking darkly of legal recourse going all the way to an injunction to prevent the diversion being carried out.

In 1909, in the matter of some minor Canadian-American rivers, the shoe was on the other foot. Prime Minister Sir Wilfrid Laurier, explaining to Parliament why he had felt compelled to accept a distasteful treaty, said:

"Was it not wiser, then, under such circumstances to say: Very well, if you insist upon that interpretation you will agree to the proposition that if you do use your powers in that way you shall be liable to damages to the party who suffers. At the same time we shall have the same power on our side, and if we choose to divert a stream that flows into your territory you shall have no right

to complain, you shall not call upon us not to do what you do yourselves, the law shall be mutual for both parties."

(For this quotation, as for much other material in these articles, I am indebted to a masterly brief prepared by Mr. Leon J. Ladner, Q. C., of Vancouver, of which he was able to read only part at the meeting here.)

Thus what was sauce for the goose half a century ago has now become sauce for the gander.

And the gander doesn't like it.

The American position on the legal aspects of the Columbia argument was put by Mr. Elwood Hutcheson of Yakima, Wash., who quoted extensively from—and appeared to be speaking on behalf of—ex-Governor Len Jordan of Idaho, the Chairman of the United States Section of the International Joint Commission.

His argument, much condensed, was that:

First. The United States had an overriding need of Columbia water for power generation, irrigation of an eventual 1 million acres, its atomic program (the Hanford Atomic Works use an immense volume of water for reactor cooling), and navigation; furthermore, a diversion into the Fraser would endanger fisheries in which the United States has an interest.

Second. In the 1909 treaty "diversion" means only normal uses of water, and not a major alteration of the river's flow, and applies only to individuals, not governments.

Third. Legally, equitably, and morally Canada has no right to divert a quarter of the Columbia's flow because of the common-law riparian doctrine which guarantees water to downstream users and also because of the arid-lands doctrine, developed during the settlement of the West (and actually conflicting with the riparian doctrine) of prior appropriation, or "first in time, first in law," which protects water users from future encroachments.

Fourth. The wording covering legal recourse mentions only "private parties" with a small "p" and not the High Contracting Parties, with capitals, who have overriding rights.

5. In any case, under the international-law principle of "rebus sic stantibus"—that a treaty only has force while the circumstances remain unchanged—the 1909 treaty can be abrogated.

6. Failing all this, the treaty itself provides that it can be terminated on a year's notice.

The Canadian legal position, set out by Prof. C. B. Bourne, of the University of British Columbia, with such remarkable skill that he was loudly applauded by Americans to whom what he was saying was thoroughly distasteful, goes this way:

1. The language of the Boundary Waters Treaty is absolutely clear, and hence so is the Canadian right to divert Columbia water.

2. Even if the Harmon doctrine embodied in the treaty is rejected (as it is by most countries) the alternative is an agreement based on apportionment of benefits—in other words, the countries sharing possession of a river must also share the benefits from it, which makes the test of a diversion its reasonableness—and the proposed diversion is reasonable.

3. The diversion would not injure any downstream interests and the question of compensation does not arise.

4. If the question were to arise, however, the Boundary Waters Treaty gives Americans the same rights as, and no more than, Canadians; in this case the rights are defined by the British Columbia Water Privileges Act of 1892, which provides that only licensed users of water are entitled to compensation, and it is highly unlikely that the courts would interpret an American right of prior appropriation as the equivalent of a license issued by the British Columbia controller of water rights.

5. The prior appropriation doctrine invoked by the Americans applies only to actual use of water; it does not apply to plans to use water in the future; declaring the intention to build dams, or even having them under construction, is not prior appropriation.

6. As far as the Government of the United States is concerned, its only claims for compensation from Canada would be political, not legal; it is extremely unlikely that an international court would uphold them.

Here were two fixed positions, and if the countries involved had been different the argument might have been left there deadlocked.

However, the people facing each other across the table were neighbors and friends. They began to look for a compromise.

[From the Vancouver (British Columbia) Province of April 25, 1956]

COLUMBIA RIVER CRISIS: 3. THE SOLUTION—JOINT DEVELOPMENT WOULD BENEFIT BOTH

(By Peter Inglis)

(Last of three articles)

SEATTLE.—As Mr. Leon J. Ladner, Q. C., of Vancouver, observed at the close of the Columbia River roundtable of the American Society of International Law, it would be an absurdity to think of Canada and the United States taking a dispute to the International Court of Justice or to consider the possibility of the United States abrogating a treaty after the two countries have observed it for nearly half a century.

By then, however, the discussion had drifted a long way away from the technicalities of the Boundary Water Act and of Canadian rights to divert part of the river's flow, and had descended to practical commonsense.

A notable contribution came from Mr. Cameron Sherwood, onetime assistant United States attorney for the western district of Washington, who regretted that both sides had already taken insular positions and feared that if each proceeded independently both would suffer.

He argued for some sort of joint Canadian-American authority through which the two countries could share the full use of the river.

He was backed up by Mr. R. P. Parry, chairman of the Idaho Joint Commission for the Columbia River Compact.

Mr. Parry offered that compact, which has successfully reconciled what once seemed to be the irreconcilable interests of the States of Washington, Oregon, and Idaho, as a pattern for a joint Canadian-United States development and use of the Columbia.

The Columbia Basin, he argued, was a single unit, divided only artificially by the international boundary; to extract its full potential, planning must be applied to it as a whole. Doing otherwise, Canada would lose more power than she could gain by any diversion.

He proposed hydraulic and electrical integration of the two countries' share of the basin—in other words, joint use of water and joint apportionment of the power derived from it.

With this latter point, the real nub of any settlement of the Columbia dispute had at last been reached; British Columbia must receive its fair share of the power the river creates, and in practice that means a share of the power developed by the $1,500 million worth of dams now in service on the Amerian section of the river, the $1 billion worth under construction, and the additional $2 billion worth now projected.

Strangely, nobody at the roundtable pointed out that the solution creates a new problem:

Today British Columbia's needs for power are relatively small compared with those of the American States in the Columbia Basin. But they are unlikely to remain so. The British Columbia government's submission to the Gordon Economic Commission foresaw a nearly fivefold increase in the Province's power consumption between 1955 and 1975, and this would alter the proportionate Canadian and American shares of Columbia power under any pooling arrangement.

This question had to wait until after the end of the roundtable before it was tackled.

The tackler was Prof. Maxwell Cohen, who holds the chair of international law at McGill and who had flown from Montreal to speak at the annual world affairs symposium dinner, held in conjunction with the international law meetings.

He said flatly it could be done, and his views are worth quoting in full:

"The entire Columbia River problem lends itself superbly not only to regional joint planning but to regional joint management.

"The only way we can assure the maximum utilization of the resources is by a commonly designed and agreed-on operation.

"This means something corresponding to a supranational or binational authority, and lessons might well be learned from the European steel and coal community, which has handled a much more difficult task.

"The only difficulty is that during the first period of operation the United States will need more power than Canada.

"It must be clearly understood, however, that as Canada's needs increase her allocation must rise, and the United States can have no vested interest in the first temporary allocation.

"The United States can compensate for this by preparing at the very same time supplementary sources of power originating in the United States such as, first, a more efficient utilization of the United States section of the Columbia and, second and more important, the development of atomic energy sources that are likely to come to fruition in the next 15 to 25 years."

In other words, American power for Canada, not Canadian power for the United States.

A visionary solution?

I thought so. But the Americans at the conference—many of them the hardheaded legal representatives of public bodies and private corporations with vested interests in the fullest development of the Columbia, seemed unanimous in their approval; the Seattle Times applauded Professor Cohen in a lead editorial.

And there it stands.

The disagreement that arose first from American refusal to accept Canada's terms for Canadian upriver storage of water for American turbines, and was accentuated by a Canadian proposal to divert the Kootenay into the Columbia and part of the Columbia's flow into the Fraser, has been taken out of the hands of the International Joint Commission and transferred to the ministerial and diplomatic level.

And here in Seattle a number of Canadians and Americans of good will have given the problem its first complete airing—with the Department of External Affairs and the State Department both asking for verbatim transcripts.

Perhaps this is a start toward settling potentially "the gravest crisis in modern United States-Canadian relations" (to quote Senator Richard Neuberger's report to a committee of the U. S. Senate) in the way that has become traditional on this continent—by friendly agreement, not by conflict.

[From the Vancouver (British Columbia) Province of April 26, 1956]

THE SEATTLE TIMES SAYS: "SHARE THE COLUMBIA'S RESOURCES"

As a footnote to the series of articles about the Columbia River debate, we reprint an editorial from the Seattle Times commenting on a Canadian proposal for settling what might become a serious dispute.

"A Canadian law professor has proposed an eminently reasonable method of approaching a solution of the dispute between his country and the United States over Columbia River power resources.

"Influential figures in the Canadian Government want to divert much of the upper Columbia flow into the Fraser River and thus keep the power in Canada. United States members of the International Joint Commission say that such action would infringe upon this country's vested rights.

"Maxwell Cohen, who holds the chair of international law at McGill University, Montreal, says many points might be made on both sides. But foregoing a lawyer's natural inclination to develop legal issues, he suggests a broader commonsense approach: Why shouldn't the two friendly countries agree on a joint development plan?

"Cohen indicated that his first thought was toward a form of supranational authority, somewhat similar to the plan under which nations of Western Europe have pooled iron and coal resources. This method might not be acceptable, but some form of effective cooperation should be sought.

"The basic fact is that the Canadian portion of the Columbia River, if harnessed by storage dams, will provide millions of kilowatts of additional power—partly in Canada, partly in the United States. If the water should be diverted to the Fraser River, the cost would be tremendous. The Fraser River fisheries would be endangered. Essentially the same number of added kilowatts would be produced as if the stored waters were permitted to flow down the Columbia River route. But all the added kilowatts, under the diversion plan, would be produced in Canada.

"Canada clearly is entitled to reasonable payment, in dollars or kilowatts or both, if its upstream storage facilities are developed in a manner which adds substantially to power production at plants on the United States section of the Columbia. If the two countries approach the problem on the basis on a develop-

ment plan that will utilize the full power potential at the lowest development cost, it should not be too difficult to reach an acceptable formula for sharing costs and power.

"This would be infinitely preferable to permitting the dispute to become acrimonious, leading the two countries to the World Court, and perhaps getting a decision that would satisfy neither."

[From the Portland (Oreg.) Journal, May 29, 1955]

LIBBY DAM SHELVED BY CANADIAN DEMANDS

(By Tom Humphrey, editor, Journal Editorial Page)

MISSOULA, MONT., May 28.—The mystery over what happened to the great Libby Dam project on the Kootenai River just south of the Canadian line was torn away Friday by Len Jordan, Chairman of the American section of the International Joint Commission, in a hard-hitting speech before the Columbia Basin Interagency Committee here Friday.

The former Governor of Idaho laid it on the line by declaring that the $268-million Libby project which was at the very top of the feasibility list of the engineering committee of the Northwest Governors' Power Policy Committee a year ago has been hopelessly stymied or made unfeasible by two things:

1. The "fantastic demands" of the Canadian section of IJC for payment of storage benefits from Libby, whose reservoir would lie squarely across the international boundary.

2. The threat of Canadians to divert at least 5,000 second-feet of the flow of the Kootenai through canal flats into Columbia Lake and thence into the upper Columbia itself, thus making Libby "unfeasible." Jordan added that the Canadians also have a plan to divert the flow of the upper Columbia itself into the Fraser River which lies wholly within Canada. This project would adversely affect the downstream power potential of Grand Coulee and every other downstream dam on the Columbia.

Jordan did not discuss the possibility that this river-diversion program of the Canadians is for trading purposes, that is, to get a better deal out of United States interests for downstream benefits from Canadian storage. But he did say that the Canadian demands for another year and a half of study of the Libby and related policy problems makes it imperative for the United States to forget Libby, at least for the time, and to give most careful consideration to such below-the-border projects as Penny Cliffs and Bruces Eddy on the Clearwater and Glacier View on the Flathead River, and the middle Snake projects.

In speaking of the middle Snake development, Jordan hastily made it clear that he is "not moving into the high Hells Canyon camp." He thinks there are many better storage projects. But he did make the point that storage on our side of the border is more value to us than storage in Canada and that we should comb our own projects over thoroughly before paying the fantastic demands of the Canadians.

In a carefully documented report, Jordan also stated that after we have reached the so-called C-level stage of power and storage development in the Northwest, with 13 million kilowatts of power capacity and 21 million acre-feet of storage, the value of upstream storage in Canada and the upstream United States will slant sharply downward. He estimated that we shall reach this point by 1970.

Jordan's virtual elimination of Libby (with its 600,000 kilowatts of power and 5 million acre-feet of storage) places the Priest Rapids and John Day Dams on the main stem of the Columbia in the forefront as desirable projects, in the estimation of engineers and Government officials who heard Jordan's analysis.

The CBIAC gave prompt approval to a request from Marshall N. Dana, of Portland, chairman of the recreation subcommittee, for authority to proceed with its comprehensive study of recreational facilities in the region. In his preliminary report, Dana said that recreation as an industry has skyrocketed to $1 billion annually in the Pacific Northwest in the past decade. He estimated that nonresident tourists spend at least $300 million a year in the region and Northwesterners spend $700 million on recreation annually. He also charged that there is poor coordination between Federal, State, and local agencies responsible for recreation facilities and that existing facilities in forests and parks are inadequate and poorly maintained.

Frederick Stueck, Federal Power Commissioner and chairman of the National Interagency Committee on Water Resources, declared in a luncheon address today that since FPC was established in 1920, applications for preliminary permits or licenses have been filed on 2,159 projects. At the end of 1954 there were 657 outstanding licenses covering 6,900,000 kilowatts of existing capacity with provisions for ultimate installed capacity of 10 million kilowatts. He said that 300 projects costing a total of $5 billion are now under review by FPC.

Stueck also noted that interest in local participation in power partnership programs is most pronounced in the Pacific Northwest with projects under consideration on the Columbia, Clearwater, Willamette, McKenzie, Cowlitz, and Deschutes Rivers.

Richard A. Hertzler, civil assistant to the Secretary of the Army, told CBIAC delegates that the United States Corps of Engineers, Bureau of Reclamation, and Department of Agriculture have more than 3,000 active projects under study, projects that would cost $15,200 million. Like FPC Commissioner Stueck, he said that the magnitude of these projects makes a uniform Federal water and power policy imperative.

Dr. William A. Pearl, Bonneville Power Administrator and outgoing Chairman of CBIAC, also announced that BPA had received permission to wheel power from partnership projects over Bonneville lines to key load centers of the Pacific Northwest. This will make possible the ready integration of new projects with the Northwest power pool, he said.

Ellis Hatt, of the Department of Agriculture, succeeded Dr. Pearl as Chairman of CBIAC at Friday afternoon's closing session.

[From the Vancouver (British Columbia) Sun, March 22, 1956]

Washington Not Worried by Dam Plan

There is little official concern in the State of Washington over Canadian proposals to divert the Columbia and Kootenay Rivers.

Arthur B. Langlie, State Governor, said at a press conference here Wednesday: "We feel you should do what you want with your own resources."

Canada has proposed diverting the surplus runoff of the two rivers, which flow partly in the United States, into the Fraser River system.

This would mean developing some 4 million horsepower of hydroelectric power in Canada instead of the United States.

Fear has been expressed in the United States, principally by Senator Richard Neuberger, of Oregon, that this would work serious detriment to United States downstream interests.

"We are not worried about a diversion," Governor Langlie said, "and we don't think it would create unemployment in the State."

He said Washington State favors integration of the Columbia River Basin "for maximum use by everybody."

"When British Columbia prospers we prosper," he said.

He advocated close cooperation between the Province and the State on resources development.

[From the Vancouver (British Columbia) Province, March 28, 1956]

Canada Seeks Power Parley

P. M. WANTS COLUMBIA RIVER PROBLEMS DISCUSSED AT TOP

(By J. R. Walker, Province Washington Bureau)

White Sulphur Springs, W. Va.—The Canadian Government has asked for diplomatic-level talks on the development of the Columbia River and for a review of all boundary crossing waterpower problems involving Canada and the United States.

This was the most important domestic issue brought to a head at the talks here between the Canadian and American heads of Government. They ended Tuesday night.

Canada has decided to take the stalemated Columbia River problem out of the hands of the International Joint Commission and see if Government-to-Government talk cannot bring about satisfactory settlement of the problem of the

evaluation of downstream benefits from upstream storage and of the problem of Canadian diversion schemes.

Such talks would not be confined to the Columbia River Basin, but would cover the boundary-crossing problems in all waters from the Stikine River in the Yukon to the St. John in New Brunswick.

Mr. St. Laurent hoped that Canada's proposal for an East-West exchange of blueprints of foreign-aid programs would be taken up and handled through a United Nations agency.

Meeting Canadian reporters in his private suite, the Prime Minister elaborated on the Canadian suggestion advanced at Tuesday's Canada-United States-Mexico conference for an exchange with Russia of plans to give aid to underdeveloped areas such as India and Pakistan.

He said he hoped the proposal, placed before the conference by External Affairs Minister Pearson, would be discussed by all interested countries. He suggested it would make for more effective foreign aid and could be handled by the U. N. Economic and Social Council.

Today, Eisenhower and St. Laurent shook hands in front of the Greenbrier Hotel as the Canadian leader got into his car and drove to the airport. He flew to Washington and planned to transfer to another plane for the rest of the trip to Ottawa.

"It has been extremely nice," St. Laurent told Eisenhower.

"I hope you found it worthwhile," Eisenhower replied. "I hope we can do it again sometime. And if we do it again, we'll do it right here."

[From the Washington Post and Times Herald, April 15, 1956]

MAYBE UNITED STATES ISN'T "ON TOAST"—ST. LAURENT GIVES CANADA A JOLT

By G. V. Ferguson, editor, the Montreal Star

MONTREAL.—There is much speculation over a brief remark made by Prime Minister St. Laurent when he got home after visiting President Eisenhower at White Sulphur Springs. He said they had discussed the Columbia River power problems; that the 1909 Boundary Water Treaty contained "some gaps," and that the problems would, he expects, become the subject of direct negotiation between the two Governments.

St. Laurent is one of the notable legal figures of his generation. Why was it, people are asking, that he should admit to "gaps" in the treaty in question at a time when most Canadians believe that, on the basis of precedents established by the International Joint Commission, Canada has the United States on toast?

The fact is, apparently, that the Columbia River stakes are too big to be dealt with by the legal quibble route. It is true that early judgments of the IJC were based on United States interpretations of water law—when those interpretations favored the United States. They were accepted reluctantly by Canada.

But now, when these judgments can be turned against the United States, the American pleaders in the IJC are trying to make an about face. For months past, the Canadian and American chairmen of that body, General McNaughton and Governor Jordan, have been making faces at each other in both public and private, and no decisions have been reached.

These cannot, however, be delayed indefinitely. The United States Northwest is desperately short of power, and more than one United States proposal is before the IJC. Canada, in that area, is not short of power at all and can afford to wait.

Canada, morever, is in the happy position of being able to do pretty well what it wants with the Columbia which, for most of its course, is a Canadian river.

One Canadian scheme, which sends shivers down American backs, is to build a dam at Mica Creek well north of Canada, and then divert the river's course into the Fraser—a wholly Canadian stream. This would automatically stymie any unilateral United States projects, for the possible dams which could be built would be in the downstream part of the Columbia and the water storage for them would be in Canada.

In these circumstances Canada could practically leave the dams dry by diverting the river further north. Or it could tamper with the water storage.

Thus Canada, at least to an outsider, seems to hold all the trump cards in the Columbia River argument. It would require very high-handed treatment in-

deed on the part of the United States to get water which the Canadians were determined not to give it.

It might indeed almost require a reapplication of President Theodore Roosevelt's threat that he would settle the Alaska boundary dispute by sending troops into the Alaska Panhandle.

Nobody for an instant believes that the United States would ever again make a threat of force against Canada. There is too much wisdom on both sides of the line for that.

But there are, at the same time, a lot of Canadians—and their number increases—who do not go for any policy which hands over to the United States the use in perpetuity of Canadian resources, or resources which Canadians believe to be theirs.

They believe that the United States is running short of resources, that Canada alone can provide them, and that Canada ought to exact its own price.

In the context of the Columbia River dispute, it is pointed out by these nationalists that the British Columbia Power Corp., which services Vancouver, Canada's third biggest city, has announced that it will need 6 million more hydroelectric horsepower by 1980.

Why then should we make a Columbia River deal now just because the Americans can't wait? Let them wait, they say, and if necessary sweat. They shouldn't get our power until we are good and sure we'll never want it ourselves.

Alternatively, they suggest that we develop the power right away, and tell our American friends that, if they want it, they had better cross the line, build their plants in Canada and settle down in Canada. We will thus get the benefit of our own resources, adding to our own national income instead of that of the United States—and, as a useful byproduct, make good Canadians out of our human imports.

This argument can be punched full of holes and other Canadians are doing just that, pointing out that if we don't use our resources when there's a market for them, the day may come when they will lose their value.

But the opposition remains unmoved and stubborn. They are thinking not only of Columbia River power but of Canadian natural gas and oil. The proposal for an all-Canada gas pipeline is now before Parliament and will evoke prolonged and stormy arguments, many of which are likely to contain a high percentage of anti-Americanism.

But the pipeline can be kept a purely domestic argument. The Columbia River cannot, and it is clear from Prime Minister St. Laurent's brief remark that Canada believes the settlement of the Columbia dispute can best be done behind closed doors with as little public controversy as possible.

[From the Christian Science Monitor, April 30, 1956]

UNITED STATES, CANADA MOVE ON THORNY ISSUES

(By Bruce Hutchison, Special Correspondent of the Christian Science Monitor)

FROM CANADA

After a period of irritation and much loose talk on both sides of the boundary, the United States and Canada are moving toward the settlement of three large international problems.

Two of them—the future use of the Columbia and Yukon Rivers—will be negotiated directly between the American and Canadian Governments.

The third—the movement of Alberta natural gas into eastern Canada and the Midwestern United States—hinges very largely on the judgment of the United States Federal Power Commission.

Of these three problems the joint development of the Columbia's huge hydroelectric powers has proved the most stubborn and caused the most friction between Washington and Ottawa. Also, it is the most widely misunderstood in the United States and Canada.

TREATY QUOTED

In the Canadian view, Canada has every right under the existing treaty on boundary waters to deal as it pleases with the Columbia and its tributaries where they flow through Canadian territory.

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If Canadian power dams damage American interests downstream then, under the treaty, the damaged parties can sue for compensation in Canadian courts.

This arrangement, the Canadian Government holds, was inserted in the treaty at the demand of the United States Government and against Canada's wishes.

American officials of the Joint International Commission administering the treaty dispute the Canadian view. They say that Canada is correct so far as private interests south of the boundary are concerned.

But it is another matter entirely when a Canadian dam injures publicly owned American powerplants like those in Washington State.

DIVERSION PLANS

These disputes of law were immediately raised when Canada began to consider a diversion of some Columbia water into the Fraser River system by tunnel.

In the United States it is widely believed that Canada proposed to turn off the Columbia, or much of its flow, as it would turn off a tap.

Nothing of that sort was ever contemplated. If the diversion scheme were approved only floodwaters, now wasted in the season of summer freshet, would be turned into the Fraser system and prevented from flowing southward into the United States.

American power interests insist, however, that with additional dams on the Columbia, they can use this water and, if possible, they intend to use it.

DIRECT TALKS PLANNED

Canada is not committed to the diversion but is surveying it. This plan has caused such alarm in the United States and so divided the American and Canadian officials of the International Joint Commission that the Canadian Government has decided to bypass the Commission and deal directly with the United States Government.

Direct negotiations were suggested by Prime Minister Louis St. Laurent to President Eisenhower at their recent conference.

It is assumed in Ottawa that Mr. St. Laurent would not have announced this sharp change in policy if he were not confident that the United States would agree to it. Direct negotiations seem assured.

If they result in the cancellation of the diversion scheme this does not mean that all difficulties will be at an end.

Canada intends to build a master dam on the upper Columbia to impound water for its own use. As this dam will regulate the river's flow and prevent the present wastage of water American power interests will benefit greatly from it.

When the flow is controlled the output of American turbines will increase Canada will expect to be paid for these downstream benefits.

How shall Canada be paid? American interests will be quite wrong if they suppose that Canada is willing to accept payment in cash.

Canadian policy has long opposed the export of electricity or its equivalent in water. Where its dams increase the power potential south of the border Canada asks payment in part of that power.

In the Columbia negotiations it will ask for a portion—probably about a half—of the extra power created in the United States by Canadian dams upstream.

It remains to be seen how Washington will regard this proposal. It is certain already that the United States will never willingly concur in the diversion of a drop of Columbia water into the Fraser.

If the method of direct negotiation achieves a settlement on the Columbia, as Ottawa hopes, the future of the Yukon, though not so widely discussed, offers equal or greater difficulties.

The Aluminum Company of America has long sought the right to divert the headwaters of the Yukon through the Alaska Panhandle and there power the world's largest aluminum industry.

CANADA OBJECTS

Canada objects to this diversion as much as the United States objects to the diversion of the Columbia. Even though Canadian industry is not yet ready to use the Yukon power, the Canadian Government has stated emphatically that it will not let any Yukon water move across the Panhandle.

The method of direct negotiation thus will encounter a thorny problem.

In any case the conversations between Ottawa and Washington are expected to take many months and can hardly be finished this year.

Meanwhile the Canadian Government is in serious trouble over the movement of Alberta gas eastward to the populous urban areas of the St. Lawrence valley, and this problem involves the United States.

The Government authorized a Canadian corporation, Trans-Canada Pipe Lines, to build a pipeline from the gasfields to Toronto and Montreal, all within Canadian territory. The corporation found that it could not undertake this gigantic enterprise unless it could sell some of its gas to the Midwestern States.

EXPORT APPROVED

Reluctantly—since it is opposed in principle to the export of gas—the Government agreed that 200 million cubic feet of gas shall be exported daily by a tributary pipe starting in the vicinity of Winnipeg.

It also agreed, jointly with the Ontario government, to finance at a cost of $118 million the sector of the main pipe lying in the unprofitable area north of Lake Superior.

Despite these concessions, Trans-Canada has failed to start construction, as the Government expected, this spring. Now another corporation, headed by Frank McMahon, the leading figure in the Alberta oil and gas industry, has offered to build the pipe without Government assistance, provided it is allowed to export 400 million cubic feet of gas daily.

The Government is under heavy attack in Parliament for proposing to allow large gas exports by any corporation largely financed by American capital.

It is embarrassed by the long delay in a project strongly demanded by the gas interests of Alberta and the consumers of central Canada.

It does not know if or when the Federal Power Commission will approve imports of Canadian gas.

But it regards dependence on the Commission's decision as intolerance and is determined, if possible, to get construction of the pipeline underway this year one way or another without awaiting a ruling from Washington.

Parliament has yet to be told how this can be accomplished but it expects an early announcement from the Government.

[From the Pendleton East Oregonian, May 28, 1956]

Flooding of the Kootenai River warns us that communities on the Columbia River are not yet out of danger. A big snow pack has yet to come out of the headwaters of several streams.

It should remind us, too, that flood control in the Columbia Basin still is getting nothing but lip service from many persons in responsible positions. The tragic side of the Hells Canyon decision which permitted Idaho Power Co. to build three lowhead dams in the Snake is that the storage Hells Canyon Dam could have provided is forever lost. Other dams that could provide storage are so tied up in controversy that getting them cleared seems virtually impossible.

The Eisenhower administration has for months said that Canada was the place to get storage. The administration has sung this song knowing full well that it may never be possible to work out satisfactory arrangements with the Canadian Government. Another deal or two like the Hells Canyon fiasco will place the flood control and storage problems out of the realm of solution.

[From the Wenatchee Daily World, May 14, 1956]

TALKING IT OVER

With Wilfred R. Woods

What will it take to get some joint action with Canada on the Columbia River?

That was the subject of a discussion this week with a Canadian, one of the old-timers in the resource field.

There doesn't seem to be much hope of early decision on some of these matters. And yet Canada has a stake in the development of the Columbia River, too.

The answer that our Canadian friend made to the question was this: We won't get any joint action on the river until the Canadians can see that the United States side is prepared to take care of its power needs independently without the use of Canadian dam sites.

When this situation occurs, then you'll see some action, our friend said.

It is not too difficult to see the problem that faces Canada.

Their economic development is several decades behind ours. They don't want to see anything "given away." They are not in any rush to get dams built, particularly if there is any question about whether Canada is getting its full share of the benefits. The pressure for electric power is not the same up there as it is here. The politicians up there are sensitive to all these feelings, and that is entirely natural.

So why should they hurry?

An illustration of the point our friend made can be seen in the case of natural gas. There was no action on getting natural gas for thte Northwest from Canadian sources until we actually had a supply from our own Southwest.

There was talk from the Canadian side about dickering water for gas. It all came to nothing until we were assured of an independent supply.

Now in the case of water it gets down to something of the same thing, in the opinion of at least one very keen observer from the Canadian side. And we can't help but agree.

If Canada and the United States can't agree on terms for the building of dams, we will begin to build steam plants on this side of the line.

Every steam plant we build will reduce the feasibility of the Canadian upstream dams, for it will mean that we have already firmed up some of the downstream dams with steam power rather than storage.

So perhaps we'd better quit talking about Libby Dam and some of these joint projects for a while and concentrate on our own backyard before we worry about our neighbor's.

[From the Portland Oregonian, October 5, 1955]

CANADIAN DIVERSION SCHEME HELD THREAT TO NORTHWEST DAMS

WASHINGTON (Special).—The United States told Canada Tuesday that diversion of the Columbia River into th Fraser system would hurt the United States most severely at the Dalles Dam and at Chief Joseph and McNary Dams, even if no further new projects are built in the Columbia Basin.

Len Jordan, American representative on the International Joint Commission, said that even under the most favorable waterflow conditions, Canada could not tap the Columbia of 15 million acre-feet without it cutting into the water supply needed to turn the turbines of the Federal Government's main powerplants in the Pacific Northwest.

Jordan presented two statistical charts in the IJC meeting at Ottawa Tuesday. One showed the amount of surplus water there would be at Grand Coulee, Chief Joseph, McNary, the Dalles, and Bonneville Dams, based on the system as it now exists, for each of the water years from 1928 through 1948.

This showed that during 12 of those 20 years, there would be insufficient surplus at Grand Coulee to provide the 15 million acre-feet for Canada's diversion plan. Moreover, it showed that in 19 of the 20 years, there would be too little water at Chief Joseph and the Dalles Dams to support both them and the upstream diversion scheme. At Bonneville the chart showed 10 years of insufficient flow.

JOHN DAY DAM LISTED

The second chart was based on the assumption that the United States will ultimately build additional upstream storage dams, giving the system a total capacity of 21 million acre-feet. It also included the John Day Dam along with downstream projects now being built or completed.

This second analysis showed that Chief Joseph Dam, under these conditions, would be caught short every year with insufficient water if Canada diverted 15 million acre-feet into the Fraser. John Day and McNary Dams would be hit 19 out of 20 years, Grand Coulee 18 years, and Bonneville 15 out of the 20 years.

Jordan called attention to the charts, saying they showed "there would be no surplus water in about half of the 20 years and surplus of 15 million acre-feet would not be available except in a very few of the 20 years."

The United States did not present any estimates of the power loss that would be incurred at these projects if the Columbia is diverted by Canada, but Canadian engineers have put the loss at 5,350 million kilowatt-hours annually—or about one-fourth the total electric energy sold last fiscal year by Bonneville Power Administration.

In the IJC meeting Jordan rejected four separate proposals by Gen. A. G. L. McNaughton, Canada's representative, last spring. They were that the United States compensate Canada in return for her agreement to:

1. Raise the height of Grand Coulee Dam 42 feet, providing extra storage and backing Franklin Roosevelt Lake over into British Columbia.
2. Build Mica Creek Dam in northern British Columbia and give the United States temporary benefits from its 11,800,000 acre-feet of storage. McNaughton's plan is to use Mica Creek mainly for storage purposes integrated with a string of low-level dams on the Fraser that would be possible only if the Columbia is diverted into that river.
3. Provide storage at Murphy Creek.
4. Allow Libby Dam to be built to a height that would back water over the border up to the proposed Dorr Dam. This would not allow the large storage dam at Libby that the Corps of Engineers has been authorized by Congress to build.

"It is quite obvious that all four of the subjects proposed are intended to fit into diversion conditions," Jordan declared. He said for the United States to agree to study these ideas would "risk an assumption by others that we gave tacit approval to Chairman McNaughton's contention that a diversion of 15 million acre-feet annually can be made without injury downstream in the United States. This we are not prepared to do."

RESOLUTION ADOPTED BY THE NORTHWEST PUBLIC POWER ASSOCIATION AT ITS ANNUAL MEMBERSHIP MEETING IN SPOKANE, WASH., ON APRIL 12, 1956

"12. We are opposed to the diversion of the Columbia River into the Fraser River Basin. Instead we urge Congress to initiate early negotiations between Canada and the United States looking toward the full development of the Columbia River as a unit for the highest benefit of the people of both nations."

PRELIMINARY REPORT ON EFFECT OF MICA CREEK AND ARROW LAKES STORAGE ON COLUMBIA RIVER POWER SUPPLY IN THE UNITED STATES

(Ebasco Services, Inc.)

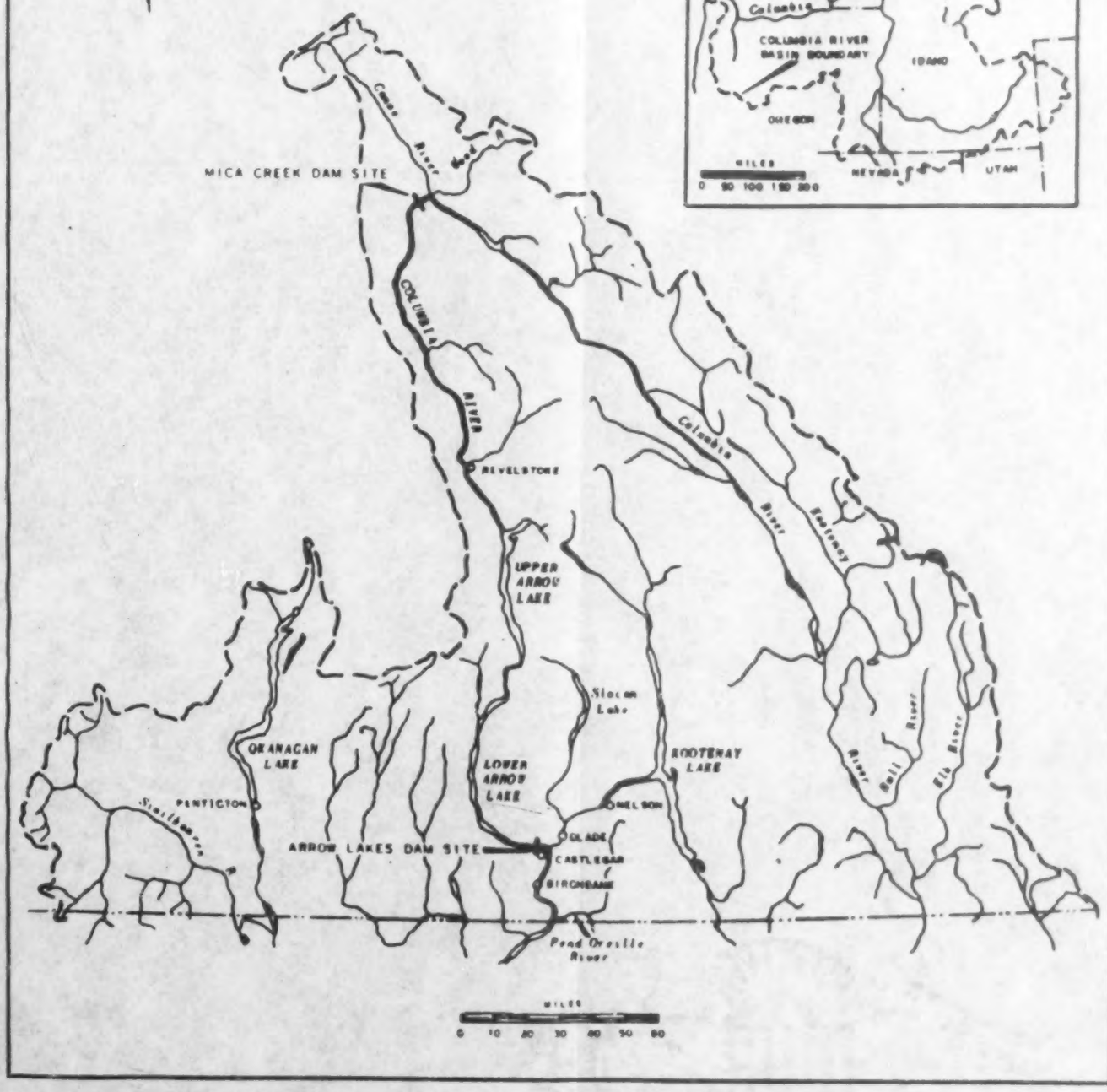
FOREWORD

Since distribution of the preliminary report of December 1954 has been more widespread than was originally anticipated, this supplementary foreword has been prepared to define clearly the purpose and limited scope of the preliminary studies covering the effects of Canadian storage on downstream plants on the Columbia River.

During the past year, four major electric companies operating in the Pacific Northwest formed the Pacific Northwest Power Co. They have been studying numerous undeveloped hydro sites in the area with a view toward meeting their anticipated combined load growth by the joint construction of large hydroelectric projects. Since all four companies are members of the Northwest power pool, estimates of their future loads must take into consideration probable load growth in the area as a whole. Likewise development of new projects by the four companies must be coordinated with present and undeveloped power resources of other members of the pool.

Among the undeveloped resources, the possibility of constructing large storage reservoirs in the Canadian portion of the Columbia Basin has received extensive publicity. Such large upstream storage could materially affect the energy output of United States generating plants on the main stem of the Columbia, thereby affecting the basic power development plans for all other members of the Northwest power pool. Under the circumstances, it was deemed advisable to supplement the studies of additional power resources with a preliminary study of the potential effects of Canadian storage on the power supply.

COLUMBIA RIVER BASIN IN CANADA



These studies were not intended to provide a basis for even tentative conclusions as to the economic feasibility of Canadian storage developments nor were they intended to provide data adequate for an economic evaluation of power and nonpower benefits at downstream plants in the United States that would be attributable to Canadian storage developments. Consequently, these studies do not include consideration of many factors that would be essential elements of a complete economic evaluation of Canadian storage, such as—

(1) Power and energy that could be generated at the site of Canadian storage developments.

(2) Potential net benefits of integrating operation of generating plants at Canadian storage developments with the operation of the generating resources of the Northwest power pool.

(3) Determination and evaluation of any flood-control benefits that might be realizable in the United States by reason of storage in Canada, at current and future levels of storage development in the United States.

(4) Relative economics of storage in Canada and storage in the United States with respect to both power and nonpower purposes.

(5) Determination of the long-term effects of Canadian storage on the dependable capacity and average annual usable energy at downstream United States plants.

(6) Relative economics of new thermal resources and new upstream cyclical storage as alternative sources of additional power supply for the Northwest power pool.

Information and data on which to base the studies were practically limited to statements appearing in the public press which indicated that it might be physically feasible to develop as much as 10 million acre-feet of usable storage at Mica Creek and 4 million acre-feet of storage at Arrow Lakes. However, no information was available with respect to the economic justification for these, or any other, storage developments at these sites.

For simplicity, it was decided to limit the preliminary calculations to a determination of the potential increases in prime power at downstream plants assuming full use of the storage for the following two conditions:

(1) The 8-month period similar to 1936–37 which period establishes the prime power for the pool at current levels of storage development.

(2) A 42-month period similar to that commencing in September 1928 and extending to March 1932, which period would be critical with practically complete regulation of the Columbia watershed.

Studies by the Corps of Engineers, the Bonneville Power Administration, and others have indicated that substantial amounts of storage are required for ironing out the variations between low and good water years, and that substantial amounts of storage capacity can be and are planned for development for this purpose in the United States. The need for any Canadian storage in the overall program or what preference position it should occupy are in no way a part of the study.

In view of the many uncertainties regarding the development of storage in Canada and the United States the results of the analyses cannot be regarded as definitive. However, these studies did develop general information adequate for the present purposes of the Pacific Northwest Power Co.

It must be emphasized that the use of prime power determinations for the purposes of these particular studies is not to be construed as an indication that prime power determinations are considered to be a complete and adequate basis for the economic evaluation of the downstream power benefits attributable to upstream storage.

A. SUMMARY

The possibility of development of large storage reservoirs at Mica Creek and Arrow Lakes (10 million acre-feet and 4 million acre-feet, respectively) on the Columbia River in Canada has caused speculation as to the effect this upstream storage would have on the production of energy at Columbia River plants in the United States. This report attempts to provide information on this subject by showing the prime power added at downstream plants by either one or both of these storage projects. Consideration has been given to two stages in the development of the Columbia River Basin in the United States as follows:

1. Present development including projects under construction.
2. Potential development including all head from the international boundary to the mouth of the river.

With present development the critical period for the Northwest power pool continues to be 1936–37. Studies of the effect of upstream storage from projects proposed for the Columbia Basin indicate that completion of potential development of such storage would shift the critical period to 42 months, September 1928 through February 1932.

The Mica Creek project includes a powerplant at site while Arrow Lakes is to be developed as a storage project only. If the Mica Creek project is to be operated for the benefit of the Northwest power pool, the entire 10 million acre-feet of storage would be utilized in the critical periods of the pool. However, the project is located in a sparsely populated area close to the northernmost point in the course of the Columbia River, and may not be interconnected with the pool's transmission system. It is likely that the plant would be operated to serve local industrial loads which would require a substantial uniform monthly output of energy. Under this type of operation, the critical period for the Mica Creek project would extend over 6 years, 1942–48. Only 6,200,000 acre-feet of storage would be released in the 1936–37 period and only 4 million acre-feet (net) in the 1928–32 period.

The prime power added to the Columbia River in the United States by development of this Canadian storage is summarized in the following table.

Prime power added by Canadian storage for 2 stages of development of Columbia River in United States

[Megawatts]

	Present development	Potential development
Critical period of Northwest power pool	September 1936 to April 1937	September 1928 to February 1932
Arrow Lakes storage only	310	90
Mica Creek storage only:		
Operated for Northwest power pool	950	300
Operated independently	460	70
Arrow Lakes and Mica Creek storage:		
Mica Creek operated for Northwest power pool	1,380	440
Mica Creek operated independently	970	230

Determination of the above figures was based on the assumption that there would be sufficient generating capacity at all plants to avoid waste of water.

B. NATURAL REGULATION AT ARROW LAKES

The net gain in upstream storage for the Columbia River in the United States is not represented by the entire 14 million acre-feet of usable storage to be impounded by these projects. A considerable amount of beneficial natural regulation is already provided by the Arrow Lakes. By the middle of March in each year, the inflow to Arrow Lakes has increased to a rate which cannot be discharged at the low lake level normally existing at this time of the year. Natural storage of inflow begins and continues through April, May, and June. This natural storage results from both the restricted lake outlet and the backwater created by the increased flows of the Kootenai River. Under present conditions, approximately 2,300,000 acre-feet has been stored by the end of June in each year. About 1 million acre-feet of this storage is released during July and August. The remaining 1,300,000 acre-feet is released during the low-water season and increases energy generation at downstream plants.

The prime power of the Columbia River in the United States represented by this natural storage in Arrow Lakes is 120 average megawatts in the 1936–37 critical period and 50 average megawatts in the 1928–32 critical period. All of the prime power credited to Mica Creek and Arrow Lakes storage in the tabulation in the summary section is over and above that already realized from the natural regulation provided by the Arrow Lakes.

C. PRESENT DEVELOPMENT OF COLUMBIA RIVER IN UNITED STATES OF AMERICA

The effect of this upstream Canadian storage was first considered assuming the Mica Creek and/or Arrow Lakes projects were constructed before any further

development of the Columbia River Basin in this country. Determination of the prime power added by this storage was based on the existence of the following plants.

	Kilowatts/cubic feet per second
Grand Coulee	23.4
Chief Joseph	12.5
McNary	6.2
The Dalles	6.0
Bonneville	3.8
Total	51.9

The critical period for the Northwest power pool with the benefit of this Canadian storage would still be set by 1936–37 water conditions. However, a detailed study of all the pool's resources would probably show that the period is lengthened to include August 1936 by use of this storage. It is also likely that withdrawal of storage from existing upstream reservoirs would be required earlier and to a greater extent in the first few months of the period than is necessary at present.

D. POTENTIAL DEVELOPMENT OF COLUMBIA RIVER IN UNITED STATES OF AMERICA

The second consideration of the effect of Mica Creek and Arrow Lakes storage was based on complete development of the Columbia River in the United States. In addition to projects existing and under construction, there is another 520 feet of head in the United States. This head would be developed by construction of such projects as Wells, Rocky Reach, Priest Rapids, Richland, and John Day. The energy factor would be increased from 52 kilowatts/cubic feet per second to 89 kilowatts/cubic feet per second. In determining the prime power added to this ultimate group of projects by Canadian storage, it was assumed that upstream storage would have been developed in other parts of the basin which would have shifted the critical period of the pool to the 42-month period, September 1928 to February 1932. As is indicated in the tabulation in the summary section, the prime power added in this longer critical period is only 25 to 35 percent of that added in 1936–37 even though the energy factor is increased 70 percent.

E. OPERATION OF MICA CREEK FOR NORTHWEST POWER POOL

The maximum benefit to the Columbia River in the United States from storage at Mica Creek is obtained if the storage is regulated solely for that purpose. Prime power added below the international boundary with a project at Mica Creek only and assuming the entire 10 million acre-feet of storage is discharged during the Northwest power pool's critical periods is 950 megawatts in 1936–37 and 300 megawatts in 1928–32. It is assumed that release of storage from Mica Creek can be so regulated that there will be no loss because of reregulation at Arrow Lakes. Prime power added by use of the entire 14 million acre-feet of storage available from projects at both Mica Creek and Arrow Lakes is 1,380 megawatts in 1936–37 and 440 megawatts in 1928–32.

F. INDEPENDENT OPERATION OF MICA CREEK

Because of the remote location of the Mica Creek project, it is most probable that the output from the plant at site would be utilized to serve industrial loads requiring a subsantially uniform monthly supply of energy. Serving such loads would result in a discharge from the plant that would vary only for changes in head. A check of 22 years of streamflow records, 1928–50, indicated that the critical period for the Columbia River at Mica Creek was 6 years in length, 1942–48, and that a uniform flow of approximately 19,000 cubic feet per second could be obtained in this period. The prime power added to the Columbia River in the United States by a project at Mica Creek only, operated to maintain a discharge of 19,000 cubic feet per second during the critical periods of the Northwest power pool, is 460 megawatts in 1936–37 and 70 megawatts in 1928–32. Prime power added by storage from projects at both sites and with Mica Creek discharge regulated to 19,000 cubic feet per second is 970 megawatts in 1936–37 and 230 megawatts in 1928–32.

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G. BASIC DATA AND ASSUMPTIONS

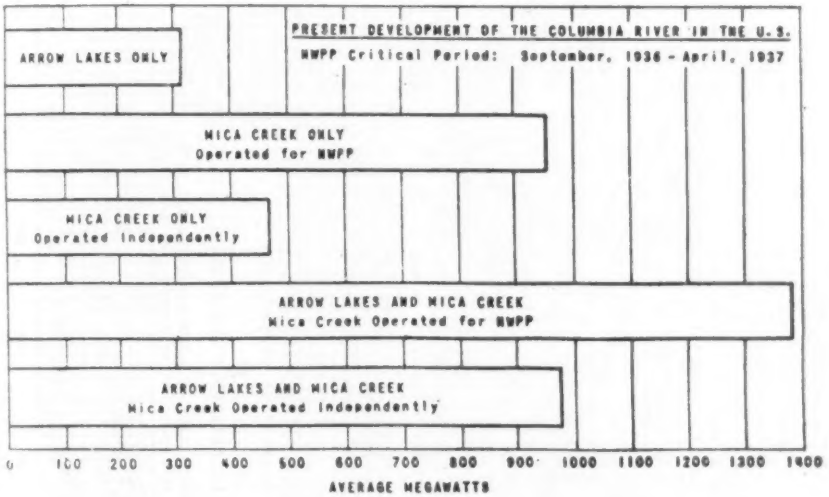
Very little reliable information is available concerning these two Canadian projects. The exact locations of the control dams have not been determined, nor have their top elevations been established. The most recent public discussions of the projects give the usable storage capacity of the Mica Creek project as 10 million acre-feet and the Arrow Lakes project as 4 million acre-feet.

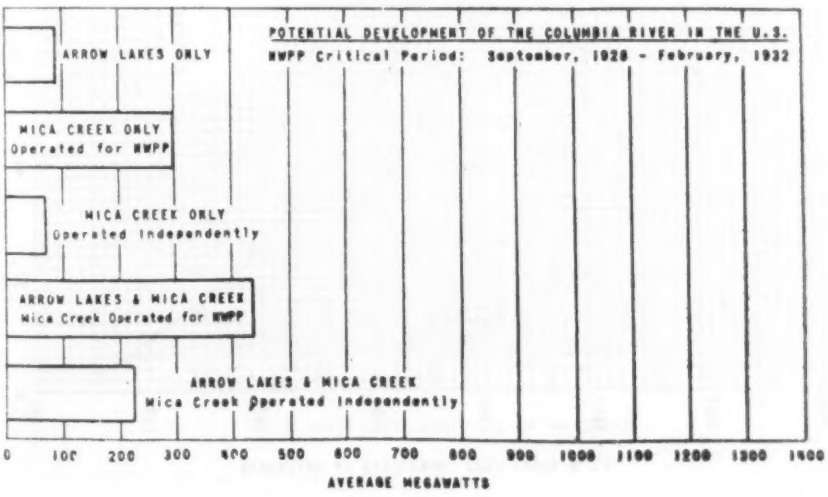
Streamflows of the Columbia River at Mica Creek and at the outlet of Arrow Lakes (Castlegar) were derived from records of the Water Resources Division of Canada's Department of Resources and Development. Flows at Mica Creek (drainage area, 8,200 square miles) were derived from the Water Resources Division's records of observed flows at Revelstoke (10,400 square miles). A correlation was obtained from a simultaneous record of flow at Revelstoke and flow near Donald at Potlatch Creek (8,220 square miles) for the period March 1947 to September 1950. Actual flow of the Columbia River at Castlegar (15,000 square miles) was derived from flow at Birchbank (34,000 square miles) less flow of the Kootenay River at Glade (19,100 square miles). Natural flows at Castlegar were obtained by adjusting these actual flows for storage changes in Arrow Lakes.

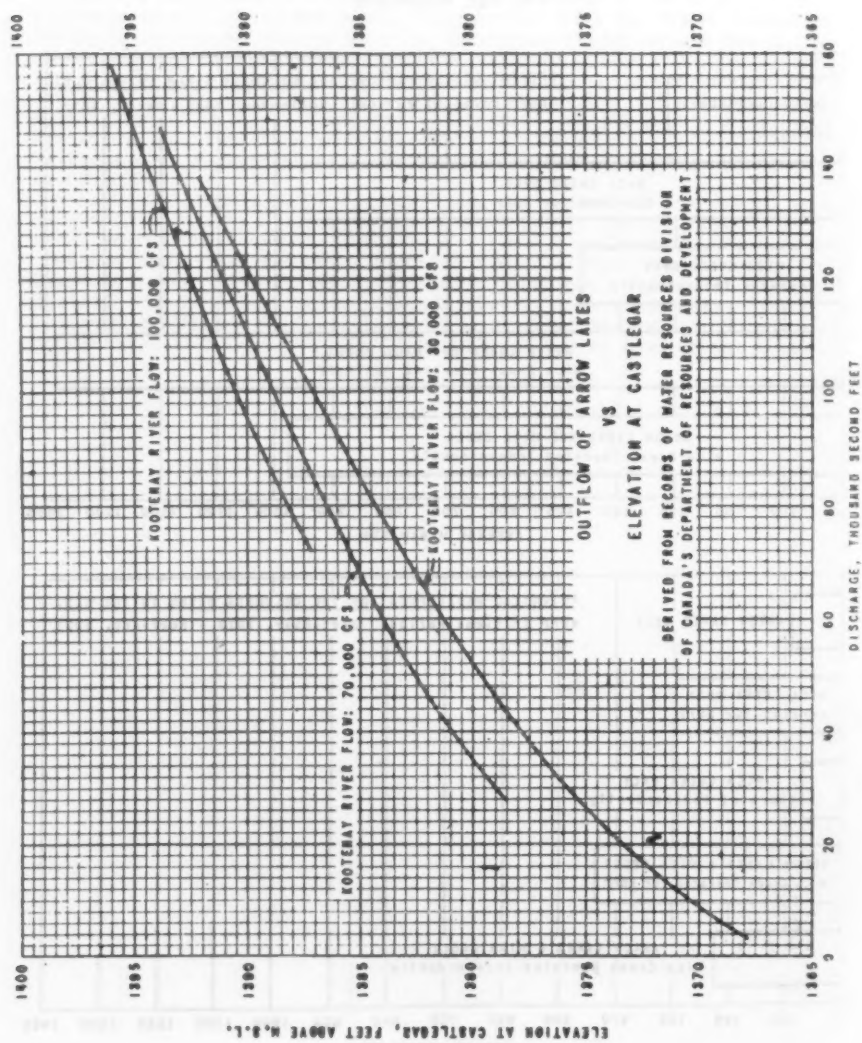
A curve of storage capacity of Arrow Lakes versus elevation at Castlegar was derived from data in a report, Storage Possibilities in Arrow Lakes, by C. E. Webb, district chief engineer, Dominion Water and Power Bureau, May 6, 1942.

It was found that discharge from the Kootenai River, which enters the Columbia a short distance below the Arrow Lakes, has a backwater effect on discharge of the Columbia through the natural outlet from Arrow Lakes. Curves of natural discharge from Arrow Lakes versus elevation at Castlegar for a range of discharges at the mouth of the Kootenai were derived from official records.

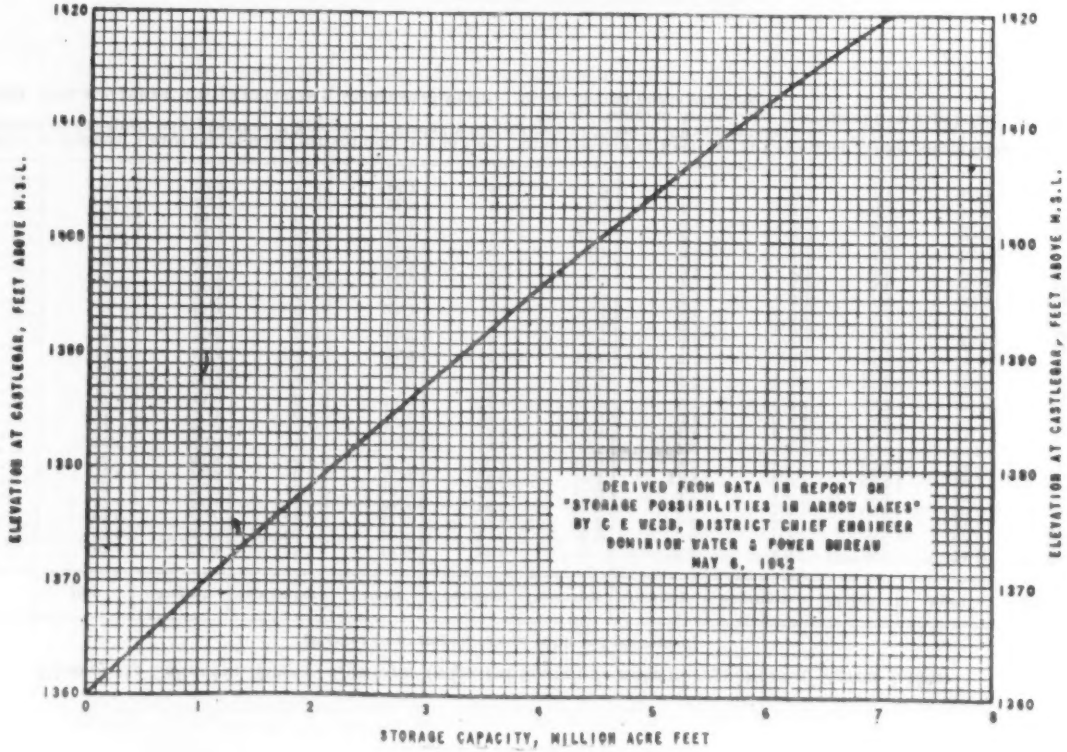
PRIME POWER ADDED TO THE COLUMBIA RIVER IN THE UNITED STATES
BY MICA CREEK AND ARROW LAKES STORAGE
AVERAGE MEGAWATTS


PRESENT DEVELOPMENT OF THE COLUMBIA RIVER IN THE U.S.
NWPP Critical Period: September, 1936 - April, 1937
ARROW LAKES ONLY
MICA CREEK ONLY
Operated for NWPP
MICA CREEK ONLY
Operated Independently
ARROW LAKES AND MICA CREEK
Mica Creek Operated for NWPP
ARROW LAKES AND MICA CREEK
Mica Creek Operated Independently
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400
AVERAGE MEGAWATTS


POTENTIAL DEVELOPMENT OF THE COLUMBIA RIVER IN THE U.S.
NWPP Critical Period: September, 1928 - February, 1932
ARROW LAKES ONLY
MICA CREEK ONLY
Operated for NWPP
MICA CREEK ONLY
Operated Independently
ARROW LAKES & MICA CREEK
Mica Creek Operated for NWPP
ARROW LAKES & MICA CREEK
Mica Creek Operated Independently
0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400
AVERAGE MEGAWATTS


ELEVATION AT CASTLEGAR, FEET ABOVE M.S.L.
1400
1395
1390
1385
1380
1375
1370
1365
KOOTENAY RIVER FLOW: 100,000 CFS
KOOTENAY RIVER FLOW: 30,000 CFS
KOOTENAY RIVER FLOW: 70,000 CFS
OUTFLOW OF ARROW LAKES
VS
ELEVATION AT CASTLEGAR
DERIVED FROM RECORDS OF WATER RESOURCES DIVISION
OF CANADA'S DEPARTMENT OF RESOURCES AND DEVELOPMENT
0
20
40
60
80
100
120
140
160
DISCHARGE, THOUSAND SECOND FEET
ELEVATION AT CASTLEGAR, FEET ABOVE M.S.L.

STORAGE CAPACITY OF ARROW LAKES
VS
ELEVATION AT CASTLEGAR



Flow of the Columbia River at Castlegar (adjusted to exclude natural regulation of Arrow Lakes)

[Figures are average thousand cubic feet per second]

	July	August	September	October	November	December	January	February	March	April	May	June
1928–29	107.3	70.0	35.7	18.6	12.1	8.5	6.2	4.6	6.8	14.6	46.4	114.4
1929–30	76.3	64.9	36.9	15.2	10.0	8.0	7.9	7.4	8.7	32.8	62.1	106.0
1930–31	98.0	71.7	39.3	13.6	9.4	6.7	6.2	5.7	7.9	14.5	71.6	115.6
1931–32	87.0	59.4	42.0	20.8	18.6	10.9	8.2	7.9	15.3	30.0	88.4	142.5
1932–33	93.4	74.0	33.0	19.6	16.5	13.0	9.7	7.0	7.9	16.5	70.4	133.1
1933–34	121.6	76.9	40.8	26.0	23.6	14.4	11.8	9.9	13.5	58.5	110.8	111.1
1934–35	86.1	63.8	36.0	21.4	21.1	12.6	9.2	12.1	10.6	14.4	63.1	117.4
1935–36	120.7	61.8	40.3	18.3	10.3	8.5	7.2	4.6	7.1	29.5	97.2	121.5
1936–37	82.5	61.2	32.5	17.5	7.9	6.6	4.1	5.2	5.2	11.7	50.7	95.7
1937–38	85.4	51.1	36.6	12.4	28.5	10.3	9.1	6.9	9.3	19.7	77.8	121.5
1938–39	88.5	42.0	43.7	19.9	11.9	7.6	8.5	6.3	7.2	25.0	94.5	84.1
1939–40	90.2	61.0	32.8	25.0	16.2	16.1	8.4	8.2	12.1	26.0	83.6	103.3
1940–41	90.8	56.5	45.7	34.9	12.0	9.9	7.7	7.5	11.3	32.8	62.1	87.6
1941–42	78.4	56.5	35.0	32.0	17.3	15.1	7.1	7.3	6.5	17.2	66.5	87.2
1942–43	96.1	62.5	25.8	18.8	9.7	7.5	5.5	6.7	5.8	30.4	44.5	78.4
1943–44	102.4	55.5	26.6	19.2	9.4	7.4	6.7	6.0	5.4	14.7	56.0	89.6
1944–45	61.4	53.1	38.6	23.3	16.9	8.4	8.0	6.9	7.5	10.0	57.9	94.9
1945–46	74.2	49.1	27.5	15.0	10.4	6.9	7.1	6.2	7.7	32.3	104.9	126.8
1946–47	92.7	57.2	33.0	13.2	8.4	8.5	7.1	7.5	8.6	26.3	85.7	115.7
1947–48	94.4	49.1	32.8	31.3	15.9	9.4	7.9	6.6	6.3	15.0	96.9	152.4
1948–49	70.4	65.6	32.8	22.5	13.6	8.2	6.6	7.1	7.4	23.8	91.5	104.3
1949–50	65.7	54.3	29.3	15.0	13.8	12.4	5.1	7.9	7.8	13.5	50.9	138.5
1950–51	123.0	64.4	37.8	20.9	15.8	13.1	9.9	8.6	6.9	20.0	94.7	92.9
1951–52	107.5	52.1	25.5	21.9	10.9	8.5	6.6	7.1	6.5	24.5	85.8	101.9
1952–53	90.8	59.4	26.3	19.1	9.2	6.9	7.1	7.9	7.0	12.0	69.5	106.8

Prior to June 1944: Flow at Castlegar (15,000 square miles) derived from flow of Columbia at Trail or Birchbank (34,000 square miles) less flow of Kootenay at Glade (19,100 square miles).

Subsequent to June 1944: Flow at Castlegar derived from flow o fColumbia at Birchbank less flow of Kootenay at Corra Linn (17,800 square miles) less flow of Slocan at Crescent Valley (1,270 square miles).

Storage change in Arrow Lakes determined from gage heights at Castlegar and curve of lake storage versus gage heights.

Flow of Columbia River at Mica Creek Dam site

[Figures are average thousand cubic feet per second]

	July	August	September	October	November	December	January	February	March	April	May	June
1928–29	64.0	27.5	18.8	7.0	4.5	3.9	4.8	2.8	2.8	2.8	18.1	55.5
1929–30	43.5	38.2	23.5	7.5	3.0	2.9	1.5	1.6	4.2	13.0	23.8	55.6
1930–31	62.0	45.5	24.0	8.0	4.8	2.7	1.7	1.5	3.0	5.6	27.8	58.0
1931–32	53.5	38.0	27.0	11.5	8.5	4.2	1.7	2.5	6.0	11.0	35.0	66.5
1932–33	54.5	45.0	19.0	10.5	7.5	5.4	4.0	2.5	3.0	5.4	25.5	60.0
1933–34	71.5	49.0	23.0	13.0	10.0	5.5	5.0	2.1	4.2	21.0	52.0	59.5
1934–35	55.0	40.0	20.5	12.5	9.5	5.0	2.8	3.5	4.1	4.5	22.5	56.5
1935–36	70.0	38.5	23.5	10.5	5.5	4.0	3.0	2.4	3.0	10.1	41.0	58.5
1936–37	50.5	40.5	20.5	10.5	4.6	2.7	2.0	1.5	4.3	5.4	19.5	45.0
1937–38	52.0	33.0	23.5	13.0	10.0	5.5	2.8	1.7	3.4	12.0	28.5	59.0
1938–39	56.0	29.5	28.5	12.5	5.5	5.0	5.0	2.1	4.3	9.4	41.5	42.5
1939–40	55.5	42.0	21.5	12.5	9.0	7.5	3.5	2.8	4.2	9.2	34.5	54.5
1940–41	59.0	35.0	27.0	21.5	7.0	5.0	2.5	2.4	4.0	13.0	27.0	46.0
1941–42	52.0	37.5	20.0	15.0	8.5	6.5	2.8	2.1	2.5	6.5	26.5	45.0
1942–43	59.5	42.5	18.0	11.0	4.8	3.3	1.7	2.0	4.5	12.8	19.5	37.0
1943–44	62.0	40.5	17.5	11.5	4.8	2.1	1.6	2.1	2.8	5.8	24.0	46.5
1944–45	41.0	35.0	25.5	13.5	8.0	4.5	3.0	3.0	3.1	3.3	22.0	45.5
1945–46	47.5	33.0	17.5	8.5	4.0	2.8	1.6	1.6	3.0	6.6	43.5	63.5
1946–47	57.5	38.5	21.0	7.8	4.0	4.5	4.0	3.1	3.6	10.3	37.9	60.5
1947–48	59.2	32.7	21.0	15.8	7.8	4.9	3.9	3.1	2.8	5.6	38.9	78.0
1948–49	46.8	41.7	21.7	11.4	6.9	4.1	2.8	2.4	2.8	7.0	33.3	38.9
1949–50	37.2	32.4	17.2	8.0	6.2	4.0	2.4	2.4	2.9	4.7	17.6	66.4
Average	55.0	38.0	21.8	11.5	6.6	4.4	2.9	2.3	3.6	8.4	30.0	54.5
Median	55.3	38.4	21.3	11.5	6.5	4.4	2.8	2.4	3.2	6.8	27.4	56.0

Prior to March 1947: Flows at Mica Creek (8,200 square miles) derived from observed flows at Revelstoke (10,400 square miles) on basis of simultaneous record of flow at Revelstoke and flow near Donald at Potlatch Creek (8,220 square miles) March 1947 to September 1950.

Subsequent to March 1947: Flows are observed flows near Donald at Potlatch Creek.

UNITED STATES SENATE,
Washington, May 11, 1956.

Re upper Columbia River hearings.

Mr. JACK STEVENS,
Seattle, Wash.

DEAR MR. STEVENS: Thank you for your letter of March 30, 1956, with the statement of the Puget Sound Utilities Council concerning the Mica Creek proposal made to Canada. While this statement was of value to the committee, it left unanswered several questions which have been raised in the hearings concerning the feasibility of the proposal. Your statement will be included in the record of the next hearings, which are presently scheduled for May 23, 1956.

Enclosed is a copy of the prepared statement submitted by Mr. Len Jordan for the record during his appearance on May 22, including the Summary Report on Special Interagency Study, United States and Canadian Storage Projects, Columbia River and Tributaries, dated April 15, 1955. I am also enclosing a copy of a Preliminary Report by Ebasco Services, Inc., on the Effect of Mica Creek and Arrow Lakes Storage on Columbia River Power Supply in U. S. A., dated December 1954, which it is planned to include in the record of the May 23 hearings.

My purpose in forwarding this material to you is twofold. First, it is desired to obtain your critical analysis of the two reports, including both the assumptions used and the conclusions reached. Secondly, the committee would like very much to have your views on the possibility of reaching some form of agreement with Canada for the construction of Mica Creek if the future projections of either of these reports are used, and on what form such an agreement might take.

The point in question, of course, is that according to these analyses if any except the present base system is used, it would seem that the proposal your organization has made to Canada would be quite infeasible, and in the interest of presenting a complete record it is believed that your analysis and refutation of this view should be included in the transcript, as well as your justification of your own assumptions and conclusions.

It would greatly assist the committee if you could have your reply to this letter back to the committee in advance of the May 23 hearings. Any additional comments you may care to add will be quite welcome.

Very truly yours,

JAMES E. MURRAY, *Chairman.*

SEATTLE 4, WASH., *May 29, 1956.*

Hon. JAMES E. MURRAY,
Chairman, Committee on Interior and Insular Affairs,
United States Senate, Washington, D. C.

DEAR SENATOR MURRAY: In accordance with your letter of May 11, 1956, I have reviewed the Summary Report on the Special Interagency Study, United States and Canadian Storage Projects, Columbia River and Tributaries, dated April 15, 1955, and the Preliminary Report, Effect of Mica Creek and Arrow Lakes Storage on Columbia River Power Supply in U. S. A., dated December 1954, and prepared by Ebasco Services, Inc. Enclosed are my statements concerning these reports.

I have confined my comments to the Mica Creek project, and have not attempted to analyze the Arrow Lakes storage development proposed by the Kaiser Aluminum & Chemical Corp. I have, of course, considered the amount of natural storage at Arrow Lakes under present conditions, and its effect on power production at downstream plants.

I wish to emphatically state that I disagree with the Federal interagency report which attempts to prove that Canadian storage will have no long-term benefits. The interagency analysis was put together on the basis of unsound assumptions with regard to future projects to be constructed and incorporated in the Federal, or regional, system operation. My statement regarding the interagency report is clear on this point.

The Ebasco Services report is admittedly preliminary in nature, and was not prepared with the intent of proving, or disproving, the merits of Canadian storage. The intent of the Ebasco report was to show what additional power supplies would be added to the Northwest power pool.

My own analysis shows the Mica Creek project to be extremely attractive to both Canada and the United States. I am confident the project will be constructed.

Representatives of the Puget Sound Utilities Council have met with representatives of the Province and Dominion Governments to discuss the possibility of council participation with the Canadians in the development of the project. The council's interest has in no way diminished during the past 2 years since conferences were first started on this matter. The council proposed to invest $250 million for the construction of the Mica Creek Dam, the ownership was to be with the Canadians; and the council's sole stipulation was that storage be released so as to produce the maximum prime power in a coordinated operation of Mica Creek and the Federal Columbia River system. All plants would be integrated with the Northwest power pool. By this procedure, there would be hydraulic and electrical integration between the Northwest power pool and the Mica Creek project. This would be a simple matter since load and streamflow patterns in both countries are much the same. Complete integration would require interchange of electric energy back and forth across the border as loads and streamflow characteristics change throughout the year. The council has at no time visualized an isolated operation for Mica Creek wherein storage releases would be made solely for the benefit of either the British Columbia or United States plants.

Although the Puget Sound Utilities Council suggested the financing of the Mica Creek Dam, this is only one of a number of arrangements that might be worked out with the Canadians. The council's position is elastic in this respect, and as a matter of fact, no written formal proposal has ever been tendered the Province or the Dominion. The council is interested only in an arrangement that will provide equitable benefits to the region, on both sides of the international boundary. This point has been emphasized at all of the meetings held between representatives of the council and Canada. The final arrangement will, of course, be one of economics since the council will not be interested in power that costs in excess of similar amounts that can be developed in the United States. My analyses indicate that power can be made available to the council as the result of storage releases at Mica Creek at costs lower than at projects remaining to be developed in the United States portion of the Columbia Basin.

Much has been said about the power potential of the Pacific Northwest and, indeed, it is great, but conflicts with nonpower interests are developing to the point where it is becoming increasingly difficult to find a project that can be constructed at a reasonable cost and within a reasonable period of time. This is particularly true of storage projects. Statements have been made to the effect that there are a number of good, large storage projects remaining to be developed in the United States portion of the Pacific Northwest, and that these should be developed ahead of Canadian storage. Unfortunately, this is not the case. Most major storage projects are in serious conflict with nonpower interests, and there appears little likelihood that the conflicts will be reconciled.

The interagency report states that somewhat beyond the so-called C level of development, costs of power from remaining hydroprojects will be at least as costly as steam-electric developments. This is purely conjectural and certainly present steam-electric costs should not be used as a basis of comparison. Fuel costs will rise due to inflationary causes and the increasing scarcity of fuel supplies. During the payout period of a steam-electric project, costs will most likely increase, and costs of steam-electric power will remain high even after the project is paid off. This is true because fuel costs will be high, and fuel costs represent the major cost item of steam-electric power. On the contrary, the cost of power at a hydroplant will be almost constant throughout the payout period, and costs will reduce greatly when the project is paid off.

In conclusion, I wish to emphasize that in my opinion, an equitable arrangement can, and will, be worked out with the Canadians for the construction of the Mica Creek project. I am hopeful that the Puget Sound Utilities Council will be able to participate with the people of British Columbia in the development of Mica Creek, and possibly other mutually beneficial storage projects. The council is working toward this end, and its confidence in the project is in no way dampened by the special interagency study, or by the preliminary report prepared by Ebasco Services.

Sincerely yours,

JACK D. STEVENS, *Consulting Engineer.*

STATEMENT BY JACK D. STEVENS REGARDING THE SUMMARY REPORT ON THE SPECIAL INTERAGENCY STUDY DATED APRIL 15, 1955

The Summary Report on the Special Federal Interagency Report, dated April 15, 1955, has to do with United States and Canadian storage projects. Table 2 of the report shows that 1,076,000 kilowatts of prime power (at market) would be added at Federal downstream Columbia River plants from storage releases at the Mica Creek project. This is on the assumption that Mica Creek would be the next storage project added to the present United States Federal system of existing projects, plus those under construction. The above figure of 1,076,000 kilowatts delivered, checks reasonably with the figure of 1,115,000 kilowatts (at point of generation) used by Jack D. Stevens. The difference could represent transmission losses in delivering power to load centers.

The interagency report examines Mica Creek storage benefits on the assumption that construction of the Mica Creek project would follow the completion of a list of so-called C-level plants. Under that assumption, Mica Creek construction would follow such highly controversial projects as Glacier View and Paradise. By this procedure, the prime power attributable to Mica Creek storage would be greatly reduced. As everyone knows, these two United States projects are in serious conflict with other interests. In the case of Glacier View, the history of the objections to that project is well known. It is strongly opposed by the National Park Service and wildlife enthusiasts. Paradise was opposed by local interests at the time of the Army's public hearing on that project. Objections included those of the Flathead Indian Tribe, the Montana State Grange, the Montana Chamber of Commerce, and various local organizations and interests. Since then, the Montana Power Co. filed on the two Buffalo power sites in the Paradise Reservoir area. In some instances, the Federal agencies have used the expression "Paradise, or alternate," "Glacier View, or alternate." So far none of the agencies has been able to specify any reasonably assured alternates.

The so-called C-level is nothing more than a list of existing and potential projects. The potential projects were at one time considered to have economic feasibility, but economics and other aspects have changed considerably on many of the projects during the past few years. This accounts for the fact that the Army is now reviewing the 308 report in the light of conditions as they now exist. The C-level is recognized as being obsolete, impractical, and impossible of accomplishment. The so-called D-system is even more so.

It is a well-known fact that as large amounts of new storage are added to a system operation, the last added block is less effective than those added earlier, if the last block has the effect of widening out the system storage drawdown period. If Mica Creek storage were added to the present system, it would add 1.1 million kilowatts of prime power over a 20-month storage drawdown period. If it were brought into operation after completion of the so-called C-list of projects, it would add only about 460,000 kilowatts.

A power project should be evaluated on the basis of what it will add to system prime power generation when constructed as a unit of a definitely known system. Each project added later should stand on its own feet. If a project lacks economic justification it should not be constructed. If Mica Creek storage were first added, it should receive credit for the 1.1 million kilowatts of prime power it would produce at downstream Columbia River plants. The same should hold true for Libby if it were first added. Certainly new projects should not be evaluated on the basis of their being constructed after such highly doubtful developments as Glacier View and Paradise are included in the system. If that procedure is followed, the utilities will have small interest in developing new blocks of storage above Grand Coulee.

During the past few years there has been a veritable epidemic of filings on power sites by Northwest utilities. Some 35 sites have been filed upon by 17 applicants. None has filed on Glacier View or Paradise. The Montana Power Co. has filed on the two Buffalo sites which are in the reservoir area of the Paradise project. The apparent reason that Glacier View and Paradise have not been filed upon is because no utility feels there is a reasonable chance of reconciling the strong objections to these projects.

It is highly unrealistic to examine the feasibility of a project on the assumption that its construction will follow storage projects that in all likelihood will never be built. If the feasibility of a new project is to be based on its relationship to future doubtful projects, it might be argued that each existing project should be reexamined when a new storage project is added to the Federal system.

Grand Coulee was not reexamined when Hungry Horse was constructed, nor were Hungry Horse and Grand Coulee reexamined when Albeni Falls was added to the system. Those plants were proposed and constructed on the basis of what they would add to the then assured system. Their values were not depreciated on the basis of possible effects of projects which have an excellent chance of never being constructed.

If the at-site and downstream benefits from the Hungry Horse project were redetermined on the basis of Hungry Horse being added to the so-called C system, it is doubtful if the project would be economically feasible. In any event, the geographical reservation of the State of Montana, with regard to Hungry Horse, would be seriously reduced. The 3 million acre-feet of storage at Hungry Horse, now usable with natural streamflows over a 7-month storage drawdown period, will produce about 200,000 kilowatts of system prime power at Hungry Horse and 440,000 kilowatts additional at downstream Federal plants when Chief Joseph and The Dalles are completed. This is a total of 640,000 kilowatts. If the same storage were used over the longer storage drawdown period of the C system, plus Hungry Horse, the at-site prime would reduce to 110,000 kilowatts and downstream benefits to 220,000 kilowatts, or a total of 330,000 kilowatts. This change in storage season results in a total reduction of 310,000 kilowatts of prime power. Under the geographical reservation, the at-site prime, or one-half of the total of at-site plus downstream prime, whichever is least, is allocated by the Government to the State of Montana. Under a redetermination of the prime benefits due to Hungry Horse, the present Montana reservation of 200,000 kilowatts would be reduced to 110,000 kilowatts, a loss to Montana of 90,000 kilowatts of prime energy.

SOME OF THE INCONSISTENCIES IN THE SUMMARY REPORT ON THE SPECIAL INTERAGENCY STUDY

Page 6, paragraph 3, reads as follows:

"Owing to the pressure of time, characteristics of this D-level (hydro-steam) system have not been studied in detail. In general, however, they will become somewhat as follows: (1) Available water will be used to generate maximum energy at all hydro plants, rather than maximum prime power; supplemental steam-electric energy will be generated as necessary to serve loads, especially those assigned ordinarily to run-of-river hydro plants. (2) The storage-release period will shorten drastically, reservoirs can be held at substantially higher average pool level, and generation at storage projects will be more than would be obtainable under an all-hydro system. (3) Flood control will become largely a byproduct of operation for power. (4) The overall operation of hydro plants, both storage and run of river, will be more efficient and economical than in the initial stage. In other words, at the D-level stage, storage projects in Canada will no longer afford a large advantage to the United States."

To begin with, no practical-minded person in the Northwest actually believes that the D-level system of hydroelectric plants will actually be constructed. Conflicts with nonpower interests, and lack of economic feasibility will eliminate many of the projects included in the D-level list. This is particularly true of storage projects. If we assume, for the sake of analyzing statements in the summary report, that the highly hypothetical D-level list of projects were constructed, the following comments would apply to statements in the third paragraph, page 6, of the summary report.

Referring to item (1), the statement is made that "available water would be used to generate maximum energy," rather than maximum prime power. Such an operation would require a regional load that could absorb all of the secondary energy, including that generated during the flood months of each year. When this happens, sometime between 2000 and 3000 A. D., the benefit of United States storage will be eliminated in favor of holding reservoirs full so as to use all flows over higher heads. This operation will be accompanied by a very large amount of thermal-electric generation. It does not appear that a situation such as this will occur until long after a 50-year payout period is completed on the Mica Creek storage development. Even when such a load develops in the United States, Canadian reservoirs will probably continue to be drafted for many years. The development of the economy of British Columbia is many years behind that of the Northwest area in the United States, and Canadian loads will not likely be such that they can absorb the summer high-water generation. If this proves to be the case, Canadian storage will continue

to be useful long after storage reservoirs in the United States have ceased to be drafted.

Item (2) states that "the storage release period will shorten drastically," and reservoirs will be held at substantially higher average pool levels. This could only result in an enhancement of the value of Canadian storage since storage releases at Canadian projects would be used over the shorter storage season and over a higher head at Grand Coulee. Instead of reducing the value of Canadian storage, its downstream benefits would be greatly increased.

Item (3) states that "flood control will become largely a byproduct of operation for power." Certainly if reservoirs are operated as proposed in item (1), there will be no space for flood-control operations. Potential flood damages will increase in the future as economies along the rivers increase, and flood control should therefore receive very great consideration in the future operation of storage reservoirs.

Item (4) states that "the overall operation of hydro plants, both storage and run of river, will be more efficient" after the D-level stage of development is reached. The simple answer to this is that the D-level stage of hydro development will never be reached.

Page 13, paragraph 2, reads as follows:

"* * * Another factor which makes United States storage projects relatively more attractive as the system grows is that there is more undeveloped head below these reservoirs within the United States than is available in this country below the Canadian storage projects; for example, Bruces Eddy and Penny Cliffs initially make a contribution less than one-half that of Mica Creek to generation in the United States, but their contribution at C-level is greater than that of Mica Creek. There are two reasons for this change, the first being that from 60 to 70 percent of the generation creditable to Bruces Eddy and Penny Cliffs is at-site generation and the second is that the additional head (not utilized in the initial development) below Mica Creek at C-level amounts to only 245 feet while the additional head development below Bruces Eddy and Penny Cliffs is some 471 feet."

The statement above that there is more undeveloped head below Bruces Eddy and Penny Cliffs is meaningless unless the magnitudes of streamflow are also considered. It is not true that the contribution of Bruces Eddy and Penny Cliffs would be greater than that of Mica Creek because of at-site generation at Bruces Eddy and Penny Cliffs, and because there would be more undeveloped downstream head below these plants (471 feet), than the undeveloped head remaining below Mica Creek storage (245 feet). The following tabulation shows a comparison of actual head remaining to be developed below Bruces Eddy and Penny Cliffs, and below Mica Creek. Note that the summary report failed to include Wells and Rocky Reach, both of which are under active consideration for early construction, and Hanford, now included by the Corps of Engineers in its review of the 308 report. By including these plants, the figure of 245 feet is corrected to 442 feet.

Undeveloped head at C-level

Project	Below Bruces Eddy and Penny Cliffs [1]		Project	Below Mica Creek (in United States only) [2]	
	Head (feet)	Added prime due to upstream storage (Mw)		Head (feet)	Added prime due to upstream storage (Mw)
Lower Granite	82	19	Priest Rapids	150	45
Little Goose	100	23	John Day	95	29
Lower Monumental	93	22			
Ice Harbor	100	23			
John Day	95	22			
Total	470	109	Total	245	74
			Additional undeveloped head:		
			Wells [3]	65	20
			Rocky Reach [3]	92	28
			Hanford [3]	40	12
			Total	197	60
			Total	442	134

[1] Prime power based on usable storage of 1,433,000 acre-feet at Bruces Eddy and 2,300,000 acre-feet at Penny Cliffs released over a 20-month storage drawdown period.
[2] Prime power based on usable storage of 10,500,000 acre-feet released over a 43-month storage drawdown period. (Period lengthens with 3 storage projects.)
[3] Not included in summary report.

Of singular importance is the amount of water to be used over specific heads. More water would be used over the heads below Mica Creek than over downstream heads affected by storage releases at Bruces Eddy and Penny Cliffs. A preliminary calculation of comparative power benefits indicates that Mica Creek storage, used over 442 feet of downstream undeveloped head, would amount to 134,000 kilowatts of prime power. The Penny Cliffs and Bruces Eddy storage, used over 471 feet of downstream undeveloped head, would amount to only 109,000 kilowatts of prime power. It is apparent that the undeveloped head below Mica Creek will result in greater amount of prime power because of the greater amount of water released from the Mica Creek Reservoir.

Page 21, section III, paragraph 3, reads as follows:

"Accordingly, no exaggerated concept of the long-range value of Canadian storage to the United States should be entertained. Canadian storage can be very desirable at the present time, but the initial value declines considerably in the long run, as indicated in this summary."

The above statement should be tempered with realism. If Mica Creek storage is evaluated on the basis of what it will add to the system at the time it is constructed, then its economic feasibility will extend long after a 50-year payout period. This is as it should be. A power project is evaluated on the basis of what it will add in prime power to an assured system. Its feasibility is not reexamined every time a project is added to the system. The last added plant must furnish its own justification without detracting from the value of existing projects. The sponsors of the C-level and the D-level systems should be called upon to present some measure of proof that the projects included in the C and D lists will actually be constructed.

Page 22, paragraph 1, reads as follows:

"There is no great long-term engineering advantage to the United States in Canadian storage. The margin favoring Canadian storage is rather narrow."

As a member of the General Advisory Committee, and the Advisory Committee on Power for the review of the 308 report, the writer attends meetings of these two committees. At one of these meetings, a representative of the Corps of Engineers assured the writer that the above statement is not considered correct and, therefore, Canadian storage will be investigated along with potential United States storage projects in the corps review of the 308 report.

COMMENTS BY JACK D. STEVENS REGARDING THE PRELIMINARY REPORT, EFFECT OF MICA CREEK AND ARROW LAKES STORAGE ON COLUMBIA RIVER POWER SUPPLY IN U. S. A., BY EBASCO SERVICES, INC., DATED DECEMBER 1954

The foreword to the report, page 1, paragraph 4, includes the following statement:

"These studies were not intended to provide a basis for even tentative conclusions as to the economic feasibility of Canadian storage developments nor were they intended to provide data adequate for an economic evaluation of power and nonpower benefits at downstream plants in the United States that would be attributable to Canadian storage developments."

On the basis of the above statement, the Ebasco report is presumed to be of a preliminary nature and consequently, the inconsistencies contained therein would probably not appear in a more thorough analysis. The inconsistencies pointed out below are done so only as a matter of record.

On page 2 of the foreword, last paragraph, the following statements are made:

"For simplicity, it was decided to limit the preliminary calculations to a determination of the potential increases in prime power at downstream plants assuming full use of the storage for the following two conditions:

"(1) The 8-month period similar to 1936–37, which period establishes the prime power for the pool at current levels of storage development.

"(2) A 42-month period similar to that commencing in September 1928 and extending to March 1932, which period would be critical with practically complete regulation of the Columbia watershed."

An 8-month storage period of the Northwest power pool, extending from September through April, on the basis of 1936–37 water conditions, would not apply if Mica Creek storage were added to the present power-pool system. The 10.5 million acre-feet of usable Mica Creek storage would increase the storage drawdown period to a 20-month period, extending from September 1943 through April 1945.

The 42-month period of September 1928 through March 1932, referred to in the Ebasco report, would occur only for a system that includes a large amount of cyclical storage in addition to the 10.5 million acre-feet of usable storage proposed at Mica Creek. The Army has proposed Libby and Glacier View, both of which are cyclical in nature, and both of which are strongly opposed by nonpower interests.

The first paragraph of page 3 of the foreword includes the following statement:

"Studies by the Corps of Engineers, the Bonneville Power Administration, and others have indicated that substantial amounts of storage are required for ironing out the variations between low and good water years, and that substantial amounts of storage capacity can be and are planned for development for this purpose in the United States."

It is extremely doubtful that important amounts of storage will be developed in the United States portion of the Columbia River Basin. Large storage projects proposed by the Corps of Engineers and the Bureau of Reclamation are in serious conflict with nonpower interests, and also, it appears likely that economic feasibility cannot be established on a number of them.

Paragraph 2, page 3, of the foreword states that due to the many uncertainties of the Ebasco analysis cannot be regarded as definitive. The report was intended regarding development of storage in Canada and the United States, the results for the purpose of developing general information for use by the Pacific Northwest Power Co. Comments included below recognize these limitations.

Paragraph 3, page 1 of the summary, states that—

"It is likely that the plant would be operated to serve local industrial loads which would require a substantially uniform monthly output of energy."

The figure of 1.1 million kilowatts of prime power increase at lower Columbia River plants assumes an integrated operation with the Mica Creek storage released in coordination with the operations of power-pool projects.[1] This type of operation is also envisioned by people in British Columbia with whom the writer has discussed the development and utilization of the Mica Creek storage.

The table at the top of page 3, shows 950 Mw as the prime power attributable to Mica Creek storage at downstream plants, when used over an 8-month storage period. In obtaining this figure, the engineers apparently used an average storage release over average heads at Grand Coulee and other downstream plants. A

[1] The figure of 1.1 million kilowatts is an abbreviation of the full figure of 1,115,000 kilowatts developed in power studies of Jack D. Stevens.

prime power figure obtained in this manner is deficient by the amount of increase in prime due to the creation of a higher average head at Grand Coulee due to Mica Creek storage releases. No comparable figure of prime power has been developed, since the 8-month storage period is wrong to begin with.

Paragraph 2, page 2, states that—

"Under present conditions, approximately 2,300,000 acre-feet has been stored by the end of June in each year. About 1,000,000 acre-feet of this storage is released during July and August. The remaining 1,300,000 acre-feet is released during the low-water season and increases energy generation at downstream plants."

The above statement refers to natural storage in the Arrow Lakes. Recent studies show that the actual storage effect from Arrow Lakes during the low-water period of September 1936 through April 1937 was approximately 800,000 acre-feet. The downstream benefit due to use of this natural storage over an 8-month drawdown period would amount to approximately 90,000 kilowatts instead of the 120,000 kilowatts shown in the Ebasco report.

Paragraph 2, page 3, reads as follows:

"The critical period for the Northwest power pool with the benefit of this Canadian storage would still be set by 1936–37 water conditions. However, a detailed study of all the pool's resources would probably show that the period is lengthened to include August 1936 by use of this storage. It is also likely that withdrawal of storage from existing upstream reservoirs would be required earlier and to a greater extent in the first few months of the period than is necessary at present."

The above is not a correct statement since the critical period of the Northwest power pool would change from 1936–37 to a 20-month period extending from September 1943 through April 1945.

The last sentence of paragraph 3, page 3, states:

"In determining the prime power added to this ultimate group of projects by Canadian storage, it was assumed that upstream storage would have been developed in other parts of the basin which would have shifted the critical period of the pool to the 42-month period, September 1928 to February 1932."

The so-called ultimate group of projects to be affected by Canadian storage, presumably corresponds to the D-level of development mentioned in the Corps of Engineers' 308 report. Many of the storage projects included in this D-level of development will never be constructed and, therefore, a 42-month storage period will likely never occur. The strong objections of nonpower interests to Paradise and Glacier View are so well known that no Northwest utility, nor the Federal Government, is attempting to develop either of these projects. The Army is considering the downstream Smoky Range site as a substitute for Glacier View, but it has many of the objections of the original project in that it would flood wildlife grazing areas, and would also encroach upon the Glacier National Park.

Paragraph 2, page 4, discusses an independent operation for Mica Creek, and includes this statement:

"Because of the remote location of the Mica Creek project, it is most probable that the output from the plant at site would be utilized to serve industrial loads requiring a substantially uniform monthly supply of energy. Serving such loads would result in a discharge from the plant that would vary only for changes in head."

As pointed out above, the sponsors of the project have never envisioned the Mica Creek project as an isolated operation. Studies in conjunction with establishing project feasibility have been on the basis of an integrated operation with interchange of electric energy between the Mica Creek project and the Northwest power pool.

Paragraph 3, page 4, states:

"Very little reliable information is available concerning these two Canadian projects."

The above statement is not correct, in that the Dominion of Canada has had a rather detailed report prepared on the Mica Creek project by the H. G. Acres Co., Ltd., consulting engineers. The report has not had public release, but it is known that a site location has been selected and preliminary designs and costs have been completed on the basis of usable storage consisting of 10.5 million acre-feet. The Kaiser Engineers have prepared a preliminary report dealing with the Arrow Lakes project.

Conclusion: The Ebasco report can only be considered a very preliminary and incomplete investigation of the Mica Creek project.

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ATTACK ON CANADIAN POWER

(By Grant Dexter)

THE UNITED STATES SHIFTS ITS GROUND

For 50 years it has been accepted policy at Ottawa that hydroelectric power exported to the United States is power which cannot be recovered—power forever lost to this country.

Until October 4, 1955, this was the only threat to our power resources which was believed to exist.

On October 4, at the semiannual meeting of the International Joint Commission held at Ottawa, Mr. Len Jordan, the Chairman of the United States Section, propounded a new and astonishing interpretation of the International Boundary Waters Treaty of 1909.

Mr. Jordan asserted that the United States Government, as distinct from private American persons or interests, is not bound by article II of the treaty; that the United States Government, contrary to the hitherto accepted meaning of the treaty, will seek to prevent the Canadian Government from disposing as it pleases of its own water in the Canadian reaches of the Columbia River.

Mr. Jordan's words make it plain that the United States Government, notwithstanding the provisions of the International Boundary Waters Treaty, is determined, if possible, to prevent Canada from diverting the surplus water of the Columbia out of that river and into the Fraser River system and so to the Pacific Ocean entirely through Canadian channels.

In simple terms, the significance of this sudden and shocking decision of the United States is as follows:

The United States has built 8 huge powerplants on the American stretch of the Columbia River between the United States-Canadian border and the sea. The names of these plants are well known: Grand Coulee, Chief Joseph, McNary, Bonneville, and so on.

Each spring very large quantities of floodwater rush, unused, over these dams. Later in the summer the water level falls and these plants operate below their capacity. The United States has no way of storing this surplus water.

The spring floods can be harnessed if power dams, with large natural reservoirs behind them, are built on the upper stretches of the Columbia River in Canada. Indeed the United States power interests have been so eager to cash in on this spring overflow, to do so in advance of Canadian construction, that they proposed last spring to build a storage dam (no power) on the Lower Arrow Lake, in Canada, 30 miles north of the boundary. Water thus saved from the spring floods and fed into the river in lean water months would be power gained at every one of the eight United States plants. It would produce power eight times over.

The Canadian Government rejected this United States proposal.

With the announcement, last spring, that the Canadian Government is considering the diversion of the surplus floodwaters of the Columbia River into the Fraser River system, the United States Government suddenly became aware that its great plants on the lower Columbia might never receive this precious water; that, instead, it might be harnessed to power turbines exclusively in Canada.

The amount of power involved is immense. The surveys are not yet complete but a conservative estimate is 4 million horsepower. This is what the United States stands to lose from the Fraser River diversion.

The response of the Canadian Parliament nearly 50 years ago to the threat of permanently losing hydroelectric power by export to the United States was clear. In 1907, in the first decade of important hydro power generation, the Laurier government placed exports, which previously had been allowed freely, on an annual footing. The purpose was to recover power. The aim was not achieved and, in 1909, the Sifton Conservation Commission reported to the Laurier government that power exported could never be recovered.

The truth of this opinion was speedily demonstrated. In the First World War, at a time when Canada was fighting and the United States was neutral, there was an urgent need to recover power then being exported to New York State. The United States, despite Canada's manifest need, refused to give up the power, made a major incident of the Canadian proposal, and succeeded in outfacing the Borden government.

Parliament, fully aware of what had happened, moved at once to prevent further exports. For 20 years now, there has not been a suggestion of exports. Not until last spring, when the Bennett government of British Columbia, to Ottawa's amazement, blessed the Kaiser aluminum proposal, to build a storage dam at the Lower Arrow Lake, was any such proposal even discussed by a responsible Canadian public man.

The Federal Government, of course, killed this proposition instantly and, at the last session, tightened the law in this regard.

All this is history.

But with this sudden and completely unexpected reversal of policy by the United States Government on article II of the Boundary Waters Treaty, our 50 years' struggle to retain Canada's power resources for the development of Canada has entered upon a new and very difficult phase.

ONE LAW FOR CANADA, ANOTHER FOR THE UNITED STATES

There are two opposed principles of law regarding water rights.

One comes from the United Kingdom and it remains the domestic law in Canada.

The other law is the Roman law which came to this continent via Spain and in the United States has become dominant nationally as well as in all of the States west of the Atlantic Seaboard States.

Under the English law, and this will seem eminently fair to every Canadian, the riparian owners on a river are entitled to have the river come to them from above substantially in a state of nature, undiminished and uncontaminated, and they must pass the flow along in like condition for the owners downstream.

Sir Wilfrid Laurier put it as follows: "A man may make such use as he pleases of the water which flows over his property, so long as he does not do so to the detriment of anyone else."

The Roman-Spanish-American law is exactly the opposite. It is based on the principle: "First in time, first in service." An owner is not obliged to pass the flow downstream. He may use the water without penalty, subject to one condition—once a powerplant, a storage dam or other work has been built, it becomes a vested interest and the owners of it are entitled to the water so "dedicated."

All unused or "undedicated" water is the property of the person who first uses it and thereby establishes a permanent right to it. Water so used automatically becomes "dedicated" to the user.

Before 1909, these 2 laws—the United States and the Canadian—were in conflict and the 2 countries were constantly in disputes over boundary waters and international rivers. The Boundary Waters Treaty of 1909 was designed to end these disputes. The thorniest part of the treaty negotiations was: Which water law should prevail?

The Laurier government contended for the British law but was beaten. The United States insisted on the United States law and succeeded. Laurier, in defending the treaty in the House of Commons, regretted the failure but hoped that over the years the United States law, much as he disliked it, would work out fairly for both parties.

The law is laid down in article II of the treaty. In reading this article, observe closely the use of capital letters:

"Each of the High Contracting Parties reserves to itself or to the several State Governments on the one side and the Dominion or Provincial Governments on the other as the case may be, subject to any treaty provisions now existing with respect thereto, the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters; but it is agreed that any interference with or diversion from their natural channels of such waters on either side of the boundary, resulting in any injury on the other side of the boundary, shall give rise to the same rights and entitle the injured parties to the same legal remedies as if such injury took place in the country where such diversion or interference occurs; but this provision shall not apply to cases already existing or to cases expressly covered by special agreements between the parties hereto.

"It is understood, however, that neither of the High Contracting Parties intends by the foregoing provision to surrender any right which it may have to object to any interference with or diversions of waters on the other side of the boundary the effect of which would be productive of material injury to the navigation interests on its own side of the boundary."

Nothing could be plainer. The rule is: First in use, first in service. If any person or interest in the United States believes himself or itself injured by what is done upstream in Canada he may claim damages from the Exchequer Court of Canada. In reverse, a Canadian may take action in the United States courts. The only exception concerns navigation, which does not arise in the case of the Columbia river.

Having established this law in 1909 as the international law, the United States has invoked it consistently and "ruthlessly against Canada. The United States did so by diverting the Allagash River in Maine into the Penobscot River. It did so by diverting the St. Mary River in Montana.

Both diversions were costly to Canada. But as Canada was not using this water and could not claim it as being "dedicated," there was no case under the treaty against the United States. It was hard on Canada but the Canadian Government accepted the law as agreed to in the treaty and made no protest.

Now, for the first time since the treaty was entered into, the shoe is on the other foot. The spring flow of the Columbia River, carrying 5 million horsepower in its tumultuous progress, is surplus water, unused by anyone, and therefore "undedicated."

True, the United States has nine giant powerplants ready to take this additional water when the river has been tamed by power and storage dams on its upper reaches in Canada. But the Canadian Government has discovered another use for this water which may be of greater value to Canada than the simple harnessing of the Columbia River. This other use is to siphon this presently unused flow out of the Columbia altogether and into the Fraser River system where it would spin turbines and produce power at site after site in Canada, not the United States, until it found the open sea at Vancouver.

The first reaction of the United States to this prospect is to assert that two conflicting laws exist—one for persons and companies, the other for the Governments of the two countries. The United States Government now spurns the United States law and seizes upon the Canadian or British law. The argument will be examined in detail, but briefly it is that article II of the treaty applies to all United States persons and companies but not to the United States Government.

This argument is based on the assumption—never heard of before—that injured parties are referred to in the text of the treaty in lower case letters while "High Contracting Parties" are referred to in capital letters. From this, the United States now argues that "High Contracting Parties"—that is the two Governments—are not bound by article II of the treaty.

THE UNITED STATES ARGUMENT

In examining the argument advanced on October 4 by Len Jordan, Chairman of the United States Section of the International Joint Commission, in regard to the Columbia River, the text of article II of the International Boundary Waters Treaty must always be remembered.

Here are his words:

"I think it proper to point out at this time that the injuries downstream occasioned by the annual diversion of 15 million acre-feet of Columbia water to another basin will be suffered by a Sovereign—one of the High Contracting Parties—namely, the United States of America. Obviously, therefore, the United States, as an injured Sovereign, will not be limited to the redress provided for an injured party (spelled with small letter 'p') by Article II."

Mr. Jordan added: "May we point out that the United States Government already has substantial investments in existing powerplants in the Columbia Basin amounting to about $1½ billion; in powerplants under constructions, another billion dallars; plus another estimated $2 billion for powerplants excepted to be built in the next 10 years.

"Wide publicity has been given to all of these projects. Canadian and Provincial officials have been given all of our engineering reports. Never at any time has secrecy shrouded our building and our planning. All of these projects were planned and all of the funds are committed in anticipation that the waters of these international rivers would not be utilized by Canada in such a way as to jeopardize downstream interests.

"Frankly, we are convinced that the diversion of 15 million acre-feet of water annually from the Columbia to another watershed wholly in Canada would result in very serious injury to downstream interests in the United States."

Under Canadian law, Mr. Jordan's arguments would make sense. But under American law, forced upon Canada by the United States Government in 1909 and consistently applied against Canada from that year to this, Mr. Jordan's arguments make no sense.

General McNaughton, the Chairman of the Canadian section of the International Joint Commission, has pointed out that every drop of water now being used by the United States plants on the Columbia—generously allowing for the heightening of existing dams and for cyclical droughts—would be delivered to them. Water so dedicated would not be diverted by Canada. The diversion would be restricted to the nondedicated, unused overflow, spring floodwaters.

True, if these waters were impounded in Canada on the Columbia River at the numerous suitable sites which exist, the spring overflow would not rush away wastefully. The United States plants would receive it not in the spring flood when they cannot use it (it runs to waste over their dams), but later in the season when the flow is low.

But under article II and the United States water law, Canada's right to dispose of undedicated water is clear as sunlight.

Beyond contending that the United States as a sovereign is not bound by article II Mr. Jordan made a passing, a rather misty, but a most significant reference to the effect of the Columbia diversion on the salmon-fishing industry.

The run of salmon has been greatly increased by the International Pacific Salmon Fisheries Commission. The industry is now worth $15 million annually and the potential value is placed at $26 million.

The presence of salmon restricts the power output of the Fraser system, because the water levels cannot be unduly varied without injuring the fish. But the levels could be maintained by means of the diversion, without injuring the salmon and with great benefit to power.

Mr. Jordan was not dogmatic but he indicated that the diversion of Columbia water into the Fraser River would threaten the salmon industry and be in conflict with the United States-Canada salmon treaty. Whether he meant that the United States might repudiate the salmon treaty if Canada diverts Columbia River water is not clear.

The Canadian Government, speaking through General McNaughton, and the International Joint Commission, must now reply to Mr. Jordan.

WATER RESOURCE DEVELOPMENT IN THE PACIFIC NORTHWEST—ADDRESS BY THE HONORABLE JEAN LESAGE, MINISTER OF NORTHERN AFFAIRS AND THE NATIONAL RESOURCES, BEFORE THE PACIFIC NORTHWEST TRADE ASSOCIATION, VANCOUVER, BRITISH COLUMBIA, MONDAY, MAY 9, 1955

Water resource development has been studied on several occasions by the Pacific Northwest Trade Association. Indeed it was the theme of its general conference held at Spokane in 1953. Nevertheless, I have chosen to discuss it again before you because this question has never been of greater importance and of more immediate concern to all of us than it is today.

The Pacific Northwest has an important common feature: Its economic development largely depends upon water resources and the Columbia River system is its main source of water. However, this vast region is far from being homogeneous. It is composed of several political units separated by an international boundary whose political and economic significance cannot be ignored. The region is constituted of several distinct areas which differ both in geography and in natural resources. The distinction between upstream and downstream areas, for instance, corresponds to a basic economic reality.

Up to now, these differences have not generated any substantial diversity of interests within the region. The various areas of the Pacific Northwest have grown along parallel lines, more or less independently of each other. They were in a position to exploit their respective resources and to attract new industries through their own initiative because their energy requirements could be met by developing available heads in the Columbia River system to provide on-site power. This first phase of development did not call for joint enterprise nor create a conflict of interests, with the result that the different parts of the Pacific Northwest appeared unified through complementary relationships.

As the region approaches the end of its first stage of development, it becomes evident that the unity of interest is more apparent than real. As it moves into

the second period of its expansion a new situation will arise where interregional relationships are likely to show two contradictory features. First, they will have competitive aspects. All areas depend more or less directly on water resources for their future industrial growth. However, the region's potential of cheap power, although still abundant, is limited in quantity so that the additional amounts appropriated by one area will affect the character, and perhaps will limit, the further economic expansion of the others. Thus, conflicting interests are likely to develop amongst the various areas because they will be obliged to share the same scarce commodity. Second, interregional relations will also have complementary features. Only part of the power potential of the Columbia River system can be developed through a series of dams using the available at-site head because there is a great difference between summer and winter flows. The optimum development of the basin will necessitate the construction of upstream storage facilities to provide downstream power and to keep costs low. Thus, joint action by upstream and downstream areas will in many cases be required to develop the power potential of the region economically.

This complex set of relationships is further complicated by the physical possibility of diverting flood waters from the Kootenay River into the Columbia through Canal Flats and from the Columbia River into the Fraser River system. * * * Canada's right to make these diversions is guaranteed under the Boundary Waters Treaty of 1909.

Article II of this treaty deals with this problem in the following terms: "Each of the high contracting parties reserves to itself or to the several State governments on the one side and the Dominion or Provincial governments on the other as the case may be, subject to any treaty provisions now existing with respect thereto, the exclusive jurisdiction and control over the use and diversion, whether temporary or permanent, of all waters on its own side of the line which in their natural channels would flow across the boundary or into boundary waters." The article goes on to give to any parties on the other side of the boundary who may be injured as a result of a diversion the same rights to claim damages as if the injury had been sustained in the country making the diversion. The right to object to diversions resulting in material injury to navigation interests is embodied in the treaty.

It is necessary to recall the historical background of this article to understand its significance. In Canada, the law regulating the use of water originated from the riparian doctrine. According to that principle, a downstream interest has the right "to have the water come to him forever, undiminished and undefiled." When the treaty was negotiated, Canada advocated the application of that doctrine. Sir Wilfrid Laurier stated his position as follows: "The same principle should prevail in international laws as prevails in the common law and the civil law, namely, that a man may make such use as he pleases of the water which flows over his property so long as he does not do so to the detriment of anyone else."

In the United States however, a different doctrine had come to be applied. It had originated at the time of the Roman Empire and was generally recognized by the Mediterranean countries. It was brought to America by the Spanish and spread from Mexico to California and later to the whole country. It is known as the law of appropriation. Under it a person on the banks of a stream has the right to consume or to divert the water for a beneficial purpose. No person downstream has any vested right to receive the water unless he has established an earlier appropriation of it himself. This was the doctrine which, before the treaty, had been applied by the United States against Canada on two different occasisons—the diversion of the Allagash River at Chamberlain Lake in Maine into the Penobscot and the proposed diversion of the St. Mary River in Montana. It was also applied against Mexico in the Rio Grande diversion. The United States Attorney General Mr. Harmon wrote to the Secretary of State in this connection explicitly rejecting the contention that there could be any limitation on the right of an upstream state to divert unappropriated water. Canada had been urging the contrary view, along the lines of the common law doctrine. However, Mr. Harmon said: "* * * what is really contended for is a servitude which makes the lower country dominant and subjects the upper country to the burden of arresting its development and denying to its inhabitants the use of a provision which nature has supplied entirely within its own territory. * * * In my opinion, the rules, principles, and precedents of international law impose no liability or obligation upon the United States."

This background explains why Mr. Elihu Root, the then Secretary of State, and the other United States negotiators insisted on incorporating the appropriation doctrine in the 1909 treaty and to have a provision such as article II. To prevent a deadlock, our country reluctantly accepted the United States views. Sir Wilfrid Laurier, the then Prime Minister of Canada, defined the Canadian attitude as follows:

"But in this case, whether we liked it or did not like it, the United States had taken the position that international law provides that, except in matters of navigation, the upper power has right to use the water within its own territory as it thinks best. What were we to do? They might do so, and if they did so, they might do it to our injury and we had no recourse whatever. Was it not wiser, then, under such circumstances, to say: Very well, if you insist upon that interpretation you will agree to the proposition that if you do use your powers in that way you shall be liable to damages to the party who suffers. At the same time we shall have the same power on our side, and if we chose to divert a stream that flows into your territory you shall have no right to complain, you shall not call upon us not to do what you do yourselves, the law shall be mutual for both parties and both parties shall be liable to damages."

Thus, our right to divert floodwaters from the Kootenay and Columbia Rivers is clearly established as a result of the position taken by the United States in 1909. Now that, in the main area of contention, Canada represents the upstream interests, we cannot be criticized for wanting to assert a right which was more or less imposed upon us in conditions that were then against our national interests.

However, the fact that those diversions are physically feasible and that we have the right to make them does not of itself necessarily mean that they will be initiated. Economic considerations will have to be taken into account in reaching a decision. That is why an investigation is now being made on the feasibility of the Kootenay and Columbia diversion projects. Results of these surveys are expected within a year.

We want to obtain precise data on the benefits to be derived from these diversions and on their cost, including, of course, the possible damages to downstream interests. Once we know the quantity and the cost of power which could thus be made available, it will be useful to compare those data with the cost of thermal and atomic power. It will be particularly important to make such a comparison with the quantity and the cost of power that the downstream interests would be prepared to give in recompense for storage facilities if the floodwaters were not diverted. All the direct and indirect effects of these alternatives will have to be carefully examined before a final decision is reached.

This brings us back to the competitive and complementary relationships existing between upstream and downstream areas in the Pacific Northwest region and raises the complex problem of downstream benefits. Given the strong competitive factors now opposing the two main groups of interests, it is quite understandable that the downstream areas would like to keep for themselves all the downstream power made available through regulated flow and to provide compensation only in terms of money for the damage caused by the upstream storage facilities. It is equally understandable that the upstream areas should refuse such proposals, because even adequate compensation for damages does not add to their wealth. * * * They may argue, for instance, that once the head has been developed, the generation and transmission of power derived from on-peak storage cost very little, because otherwise the facilities of the power system downstream would be idle and because unused capacity in a hydroelectric plant does not materially reduce total cost, whereas the cost of providing storage may be considerable. They could claim, therefore, that most of the downstream power generated from the released storage should belong to them.

It is evident that these opposite views must be reconciled in order to reach a satisfactory arrangement. Some compromise will have to be worked out whereby the upstream areas will receive an adequate and fair share of downstream power. I am convinced that this claim of the upstream interests is perfectly justified. It should be noted that the power made available under those particular conditions is a joint product resulting from the joint enterprise of upstream and downstream interests. The downstream areas provide the head which is certainly a valuable resource, but the upstream areas contribute the storage sites which are required to regulate the flow of water and also may permit flooding above the boundary to increase the head below. It cannot be denied that a topography favorable to storage sites is a very valuable asset which can be utilized in perpetuity. It follows, therefore, that when downstream and upstream areas decide to use their respective physical assets jointly for the generation of power, they

both have a claim on the end product. Moreover, they both make their contribution in physical terms—even though some expenditures are involved to develop the natural resources—so that they are both entitled to a quantity of the joint product in physical terms. * * *

The claim that downstream benefits should be shared rests on the simple fact that both water and head are required to produce hydropower. It is not a new doctrine invoked only in Canada. It has been propounded for a long time, and it has been applied in several cases. The principle of sharing downstream benefits was asserted for the first time before the International Joint Commission by the United States in 1925, when the Canadian application for authority to build a dam at Grand Falls on the St. John River in New Brunswick was considered. In this case, it is true, the flooding caused by the dam was to take place in boundary waters, but whether storage is provided in boundary waters or in a river flowing across the boundary does not affect the validity of the principle.

Mr. Green H. Hackworth, now president of the Court of International Justice, acted as counsel for the State Department and presented the views of the United States on the Grand Falls project. In the course of his argumentation, he made several references to the principle of sharing downstream benefits and requested its application to this case. The following quotation illustrates his line of argument: "Instead of buiding a dam on the international section you are building it below, but you are using the international section for storage purposes, and since you are doing that, and since you are utilizing the soil of the United States for that purpose, then obviously the United States is entitled to some fruits of that operation."

The sharing of downstream benefits is a recognized principle of international law. In this respect, the following statement made at the Edinburg Conference of the International Law Association in 1954 by Prof. Paul Gieseke, director of the Institute for Water Rights at Bonn University, deserves to be quoted. "Indeed the latter (international treaties) frequently regulate the exploitation of water by stipulating that any waterpower obtained shall belong, not exclusively to the state or the teerritory of which the plant producing the power, i. e., exploiting the water, is situated, but to each of the states concerned in proportion to the respective gradients the river has in the territory of each state."

In our country, the doctrine of sharing downstream benefits is in the process of becoming the explicit policy of the Government of Canada which is directly concerned with this problem. According to the Canadian constitution, works built on rivers in Canada and having an effect outside the country fall under the jurisdiction of Parliament even if they are entirely located in one Province. Up to now, the Government of Canada has felt that it was unnecessary to exercise its jurisdiction and to legislate in this field. Conditions are rapidly changing, however, and, as I pointed out, a second period in the development of the Columbia River system is now starting during which important international problems will arise. Special legislation will be needed to cope with these questions and to provide guiding principles of policy designed for the protection of the public interest of the Canadian people. That is why the Parliament of Canada has been asked to enact bill No. 3, entitled "The International River Improvements Act."

Under this bill, an "international river improvement" means a dam, obstruction, canal, reservoir, or other work the purpose or effect of which is—

(i) to increase, decrease, or alter the natural flow of an international river, and

(ii) to interfere with, alter, or affect the actual or potential use of the international river outside Canada.

Such works, unless specifically excepted by regulations or by the act, would require a license from the Government of Canada. The bill would also enable the Governor in Council to make regulations concerning the construction, operation and maintenance of these works for the purpose of developing and utilizing the water resources of Canada in the national interest.

The Government of Canada has already made known the general principles which would serve to interpret the national interest in this respect. They require that a project must be compatible with present and future needs of the country and with the optimum development of the site and the whole watershed. If no effective use of the water resources can be made in Canada, the improvement executed in Canada to permit downstream utilization in another country must provide for benefits commensurate with the water resources thus made available. Projects involving the storage of water in Canada to regulate the

downstream flow must provide for long-term arrangements with the United States or some authority designated on its behalf and for a reasonable share of the downstream power or for a fair return in real terms. If, in order to launch a project in Canada, it is necessary to contract for the sale outside of Canada of a declining proportion of the Canadian share of downstream benefit power, then the sale of that power must be treated as an export of electricity and made subject to similar regulations as those pertaining to the Exportation of Power and Fluids and Importation of Gas Act. I use the expression "declining proportion" to indicate that there is no intention to alienate power permanently.

This attitude of the Government of Canada in respect to downstream benefits and to power development in general cannot be interpreted as a new trend in our thinking. It is merely an application to this particular field of a well-established policy. The Canadian Government has always thought that our natural resources should be exploited to the best advantage of our country. This is the position taken in the United States about United States resources, and it is the only responsible position that a government can take. We place special emphasis on energy in view of the fact that it is a strategic factor of industrial expansion in the framework of modern technology. Within the energy field we devote particular attention to waterpower as one of our most valuable resources. We must put it to its optimum use in Canada. We cannot be expected to make it available outside the country on terms which could hinder our own industrial progress.

Such views are shared by most Canadians. They are, as I have said, also views shared by our friends of the United States. As recently as April 9, the Governor of Idaho, Mr. Smylie, expressed them in a very straightforward way before Senator Neuberger's subcommittee. The Governor said: "In Idaho, we tire of the efforts of outsiders to foist upon us plans of development which have as their primary objective the interest of those outside this State rather than the best interests of Idaho and the Northwest as a whole. First and foremost we desire to retain and develop Idaho resources for Idaho. And we shall insist always that we do with Idaho water what is best for Idaho first."

Some people, realizing that southern British Columbia does not need at the present moment all the onsite power that can be developed and the downstream power that it could claim, may argue that it would be advantageous to let the United States Pacific Northwest have part of this power on a long-term basis at the average price prevailing on that market. This is a tempting proposition because it provides a means of making an immediate profit. It is, however, a proposition with dangerous implications.

It must be realized that British Columbia is still in its early period of expansion and that most of its resources are almost untapped. The United States Pacific Northwest has reached a much more advanced stage of development. This is not the first time that regions of the two countries show such a difference in timing of development. The Province of Ontario once thought that its power potential was much greater than its needs and that it could make part of it available to the State of New York. Just a few years later it needed that power but could not recover it. It took many years to solve this difficulty. Today, southern Ontario has almost completely developed the full potential of its water resources and its power requirements are still increasing rapidly. Where there was once a surplus of really cheap power, there will, in the immediate future, be an acute shortage.

Even at the present time, the power requirements of certain areas in southern British Columbia are doubling every 7 years. There is no doubt that if British Columbia experiences a normal rate of growth, all its cheap sources of power will be required in the next 2 or 3 decades.

If Canada does not want to see the economic future of its west-coast area jeopardized, it cannot allow the sale in the United States of onsite or downstream power from British Columbia at a price corresponding to the average cost of power presently available on that market. This power is produced at very low cost because the main projects were built during the depression and part of their cost was assigned to irrigation, flood control, and navigation. The real value of power in the United States Pacific Northwest is represented by the cost of producing additional power from the cheapest source now available in the area. Canada cannot be expected to permit the sale of its power on the United States market at price much lower than this cost. Is Canada reasonably to be expected to use its own resources in such a way as to encourage new industries to locate on the other side of the boundary where they will have immediate access to the United States market, where they will enjoy tariff protection and get cheap power as well? Our first duty is to use Canadian resources to foster Canadan develop-

ment. * * * We have always given consideration to the needs of our United States friends, and we always will, but we cannot be expected to do that to our own jeopardy. Since cheap energy is so vital a factor in industrial growth, Canada has for years taken the position that it cannot export power to the United States in perpetuity or even on a long-term basis. If it did that, it would sacrifice one of the most significant factors in its industrial expansion. Canada might find itself without cheap power to process its own raw materials and forced to export those as well. Controlled water is simply electricity in storage. The same principle applies there.

If the application of this policy results in some region having a temporary surplus of power this is no reason to think the policy is wrong. We can be sure the surplus will be only temporary. Moreover, it is not a surplus of power, but a shortage which creates great difficulties and which brings industrial expansion to an end. A temporary surplus of power is the very condition of economic progress in the age of modern technology. Power projects require several years to be completed but the demand for power may rise suddenly. That is why regions enjoying temporary surpluses possess a great economic advantage and must think twice before deciding to part with it.

As it can be readily seen, the further development of the water resources of the Pacific Northwest will no doubt create problems, difficulties, and perhaps conflicts. We might as well face them frankly and realistically. We cannot ignore the fact that even in the Pacific Northwest different areas do not have necessarily the same interests. Instead of refusing to recognize unavoidable divergences of interest we should try our best to reconcile them.

The problem of downstream benefits is probably the one requiring our most immediate and careful consideration. I am inclined to think that the discussion of this issue has been conducted in too broad terms up to now to be really fruitful. Endless discussion, unfortunately, does not generate kilowatts, as Governor Smylie recalled in the presentation to which I referred previously. It seems to me that all parties concerned should make known in the near future whether or not they accept the principle of sharing downstream benefits. As far as we are concerned in Canada, I have attempted to make our position clear on this. If there is general agreement on the principle itself, then we will have to discuss how it should be applied. Perhaps it will be possible to work out a general formula that could be applied to each case involving downstream benefits. If this is found impossible, we should at least try to agree on the factors to be considered and on their relative importance. A specific formula for the allocation of downstream power would then have to be worked out in each case. There is no easy and simple solution to the problem of downstream benefits. It is only through negotiations that we can hope to find a satisfactory compromise. Expert knowledge and a lot of good will will be required. Fortunately, there is an agency which is very well equipped to undertake this difficult task and to carry it on successfully: That is the International Joint Commission. I understand that the members of the Canadian section of the Commission have already proposed to their colleagues of the United States that a study should be undertaken now on the problem of downstream benefits. I hope that this proposal will be accepted and that such a study will be initiated in the near future. Otherwise, further delays in the development of the water resources of the Pacific Northwest will become inevitable.

The United States and Canada have a long record of peaceful relations. This does not mean we do not have divergences of interests or that, when such differences arise, either country sacrifices its interests to the other. The explanation of our friendly relations lies in the fact that we are always ready to iron out our difficulties through direct negotiations and to reach a compromise in the common interest. Associations like yours have made an important contribution to preserve our tradition of peaceful relations. You believe that there are no irreducible differences and that diverging interests can always be reconciled with good will. That is why the Pacific Northwest Trade Association can play an essential role in the solution of the complex problem raised by the further development of the region's water resources. Only disagreements and uncompromising attitudes can impair the brilliant economic future guaranteed to the Pacific Northwest by its immense natural resources.

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